AGRICULTURAL CHEMICALS

Keynote Speakers at AIFA Meeting
Washington, D. C., February 19, 20
1948

AGRICULTURAL INSECTICIDES • FUNGICIDES • STOCK DIPS AND SPRAYS
FUMIGANTS • DAIRY FARM CHEMICALS • WEED CONTROL CHEMICALS • FERTILIZERS
SOIL TREATING MATERIALS • SEED TREATING CHEMICALS • RODENTICIDES

Volume III February, 1948 Number 2

Sell Baker's 2,4-D Formulation No. 1

It kills weeds in small grains—increases yields!

All of us are doing everything we can to save wheat. Farmers feed less. Distillers use less. We eat less.

How many *more bushels* can be produced by killing weeds in wheat fields?

The USDA reports fields moderately infested with wild mustard in the Red River Valley of North Dakota, properly treated with 2,4-D, have yielded 10 to 15 bushels more wheat than adjoining untreated fields.

Greatest damage occurs in the strip of states from Maine to North Dakota, and south to Maryland and Iowa—and on the Pacific Coast. Even in semiarid states, extensive weed damage results in wet years.

With today's high grain prices—what an excellent opportunity for you to sell Baker's 2,4-D Formulation #1, a weed-killer that's "custom-made" for use on small grains!

Formulation #1 is only one of a complete line of 2,4-D formulations manufactured by Baker—each of which is especially designed to fit a particular weed-killing job. There are formulations for large scale or small operations . . . for pastures or growing crops . . . for "hard-to-kill" weeds or woody growth . . . for application by conventional sprayers, or special equipment like airplanes or fog-applicators.

Baker's rich background of skill, experience and research can be valuable to you and your customers in solving weed problems. Available under the Baker label or your own—investigate Baker's 2,4-D formulations today.

Send for FREE BULLETINS!

Get the full facts about Baker's "custom-made" 2,4-D formulations. Our free bulletins tell when, where and why to use each. We will also send other valuable reference material on 2,4-D for your files. Write today! Address *Agricultural Chemical Division*, J. T. Baker Chemical Co., 66 S. Main Street, Phillipsburg, N. J.

Baker's Agricultural Chemicals

WEEDS GO PROFITS GROW

when you specify
POWCO BRAND 2,4-D CONCENTRATES

Weeds cost the U. S. alone an estimated $3,000,000,000 yearly. When you merchandise and market a weed killer make a sure start with POWCO BRAND 2,4-D Concentrates, because POWCO BRAND 2,4-D Formulations are RIGHT for packaging, RIGHT for weed control and RIGHT for your cost sheets! Our laboratory is set up to solve your weed control problems. Our technical sales staff will be glad to help you in your weed control questions.

ISOPROPYL ESTER

Powco Brand Isopropyl Ester of 2,4-D gives more satisfactory kill of hard-to-control weeds than other formulations. It is faster acting. It is convenient to handle because it is diluted by volume and requires no weighing operation. It is a light, straw colored liquid which makes an attractive merchandising package. It forms a stable emulsion when diluted with water.

SODIUM SALT

Powco Brand Sodium Salt of 2,4-D is actually a true sodium salt of the acid. It is an economical form of 2,4-D for use in large scale application. It has a wetting agent added to make it go into solution easier and to wet the foliage better. It is adaptable to the preparation of agricultural herbicide dust.

ISOPROPANOLAMINE SALT OF 2,4-D

This Powco Brand liquid concentrate is completely water soluble. Amines are softest, and most economical form of 2,4-D. They go into solution instantly. Contains a wetting agent for more complete wetting of foliage. Use for control of weeds in cereals, corn, flax, sugar cane, rice, etc.

Write for complete information.

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CANADA: CHARLES ALBERT SMITH, LTD., TORONTO - MONTREAL
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POWCO BRAND PRODUCTS: Antu - Pyrin R - Pyrin D-20 - JP No. 10 - JP No. 25 - JP No. 30 - JP No. 50 - JP No. 50W - Pyrethrum Powders and Extracts - Stimtox "A" - Rotenone Powders - Sabadilla - Aerosol Formulas - 2,4-D - BHC (Benzene Hexachloride) - HETP (Hexaethyl Tetraphosphate).

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FOR GROWERS WHO RAISE FRUIT AS A BUSINESS

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MICRO-DRITOMIC® SULFUR

An Advanced Type of Sulfur Fungicide

Micro-Dritomic Sulfur is unsurpassed for all-around spray efficiency in control of sulfur-responding fungous diseases. Its micron-sized particles are of the finest—as fine as can be milled in commercial milling equipment. Containing 95% Pure Elemental Sulfur, Micro-Dritomic has been formulated and conditioned for smooth, convenient action in the spray tank and for best spray coverage and control performance on the trees.

PURATIZED*

AGRICULTURAL SPRAY

New & Superior Organic Fungicide For Early Protection

Puratized is a new organic fungicide which gives superior results for early season control of apple scab from delayed-dormant through first-cover spray. It has shown high effectiveness in inactivating existing scab lesions and also in protecting foliage against infection. This liquid fungicide mixes readily with water and provides a fine protective film. It is compatible with DDT or Lead Arsenate in combination sprays.

*Reg. U. S. Pat. Off. Gallowhur Chemical Corporation

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LEAD ARSENATE Astringent & Standard

AATP MITICIDES (Parathion)

BHC PRODUCTS (Benzene Hexachloride)

NICOTINE SULFATE

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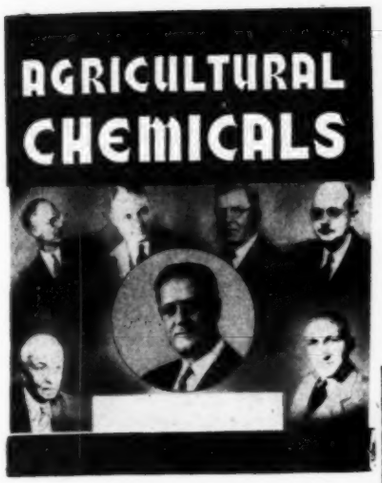
Offices Serving Principal Agricultural Centers Throughout The Nation



A Monthly Magazine For the Trade

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THIS MONTH'S COVER

Speakers scheduled to appear at the A.I.F.A. Convention in Washington this month. Center is Secretary of Agriculture, Clinton P. Anderson, keynote speaker. Others in picture, (reading clockwise) are: F. L. McDougall, C. J. Willard, C. P. Streeter, S. A. Rohwer, Wesley Hardenbergh, and H. W. Voorhees.

FEBRUARY 1948
VOL. III No. 2

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AGRICULTURAL CHEMICALS

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DOUBLE CHECKED ✓ from RESEARCH to INDUSTRY

SHARSOL

SHARSOL 221

ADVANTAGES FOR SOLUBILIZING 2,4-D ACID

✓ **MOST ECONOMICAL:** Concentrates containing one pound of 2,4-D per quart of solution can be formulated more economically with SHARSOL 221 than with other solubilizers now available. Only 140 pounds of SHARSOL 221 (anhydrous basis) are required to make 100 gallons of the concentrate.

✓ **EASY TO USE:** Formulation may be carried out in standard equipment, requiring only moderate heating and agitation.

✓ **READILY AVAILABLE:** Whether you wish to purchase drum quantities or tank cars, prompt shipment can be made.

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SHARPLES CHEMICALS INC.

PHILADELPHIA CHICAGO NEW YORK

When It Comes To

Cattle Grub Control

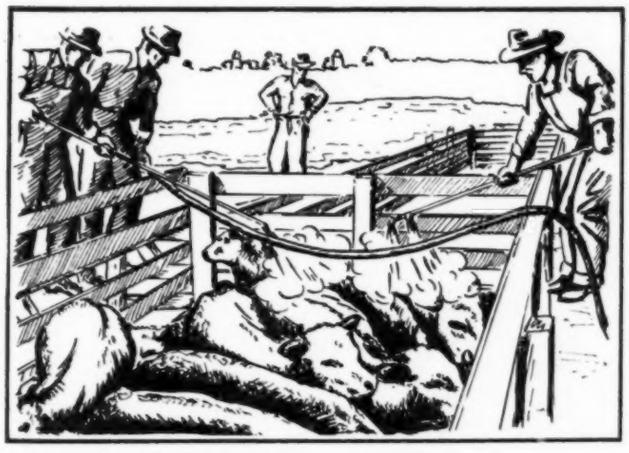
There's Nothing Like

ROTENONE!

And for the Right Rotenone Product
There's nothing like Orbiscides!

Cattle grubs in the backs of beef animals may interfere with their normal fattening. Numerous grubs in the backs of dairy cattle also may reduce the flow of milk. You can help the government's Food Conservation Program by urging your ranch and dairy customers to treat their animals promptly and plan on repeating the treatment as often as necessary.

Rotenone is the *only* material recommended by the Bureau of Entomology & Plant Quarantine for cattle grub control. It is safe, effective, and has proved its value through extensive use over a period of several years. Although Rotenone was scarce during the war, a larger supply is now available. Reports from state extension workers indicate that large numbers of cattle will be treated with rotenone during the next few months.



Bureau entomologists give the following recommendations for the use of rotenone in controlling cattle grubs:

SPRAY—Use 7½ lbs. of 5% rotenone bearing derris or cube powder to 100 gals. of water. Apply with power sprayer at 400 lbs. pressure. Use 1 gal. of spray per animal, holding the spray nozzle 12 to 16 inches from the backs of the animals. This is the treatment most commonly used.

WASH—Use 12 ozs. of 5% rotenone powder and 4 ozs. of granular laundry soap to 1 gal. of water. Apply about 1 pint per animal, rubbing it into the back thoroughly.

DUST—Mix thoroughly 1 part of 5% rotenone powder with 2 parts of pyrophyllite or Tripoli earth. Use about 3½ ozs. of dust per animal, rubbing it into the hair and grub openings with a stiff brush.

DIP—Use 10 lbs. of 5% derris powder and 2 ozs. of sodium lauryl Sulfate to 100 gals. of water. Hold the animals in the dipping vat for two minutes.

Orbis can supply you with the right rotenone product for the job in your particular locality. Write, wire or phone today for complete information. Our technical staff is ready to help you with your insecticide problems.

CATTLEMEN—Specify Orbiscide Insecticide Concentrates ordering from your local dealer.

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BOOST SALES with

Baird's "Certified" PRODUCTS

COAL-TAR STOCK DIP—Suitable for use on cattle, horses, sheep, etc. Manufactured from choice refined tar acid oil, properly emulsified. Will not deteriorate. High dilution in use gives low cost. Standard stock disease preventive product used for many years.

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NO-ROMA—Latest Development in Odorless Disinfectants. NO-ROMA is a powerful yet inexpensive all-around sanitizer. This Quaternary Ammonium Salt Compound is offered in coefficient 10, 25 and 35, colored or colorless. Ideal for dairy equipment.

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CRESTALL FLUID, U.S.A.I. Approved—For the Prevention and Control of Animal Diseases. CRESTALL FLUID has greater germicidal strength and is more powerful than cresol. Active principle is refined Cresylic Acid.

* * *

RED MITE DESTROYER—An Excellent Spray for Poultry Houses. RED MITE DESTROYER is all that its name implies. Poultry houses can be rid of Red Mites if this chemical is thoroughly sprayed 4 or 5 times a year. Red Mite Destroyer has a low boiling point.

* * *

PRESERVOL—A Wood Preservative and Protector Against Lice, Mites, Termites, Worms and Marine-Borers. PRESERVOL was primarily designed to give low-cost protection to barns, henhouses. Can be sprayed or brushed. Should be used in the Spring and once more during the year for good results.

* * *

CREOSOTE OIL—An Excellent Wood Preservative. CREOSOTE OIL is very inexpensive to use and gives complete protection against decay of fence posts, piling, fences, etc. Good penetration properties.

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ALL THE ABOVE PRODUCTS ALSO PACKED UNDER YOUR OWN PRIVATE LABEL IF DESIRED. ALL PACKINGS FROM 1 GAL. CANS TO 55 GAL. DRUMS.

Baird's
BAIRD & McGUIRE
Certified

The "Certified" Seal shown here will soon appear on all Baird & McGuire, Inc., registered labels. It is Baird's guarantee that the product on which it appears has been subjected to the most exacting chemical tests and its ingredients are exactly as represented.

Baird & McGuire, Inc.

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Serving the industry for over 38 years.

New Chicago Product Halts Cricket March
Many New Insecticides Tested For Use Against Grasshopper
New 1068 Insecticide Kills Flies "Like Flies"
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"VELSICOL 1068" CHLORDANE MAKES THE HEADLINES ACROSS THE NATION!
1068 Chemical Is Grasshopper Killer
HERE'S LOUSE KILLER; IT HAS A NAME THAT WILL DRIVE YOU BUGS
Chlordane Destroys Beetle Grubs Quickly
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FARM NEWS
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1068
"VELSICOL"
Use New Insecticide In War on Housefly
Hoppers Causing Some Concern In Pawnee County

With "VELSICOL 1068" Chlordane sweeping the press of the nation with one outstanding victory after another over insect pests it is wise to prepare now for the coming growing season with formulations of "VELSICOL 1068" Chlordane. These outstanding trials and applications clearly demonstrate control of such pests as Grasshoppers, Cotton Flea Hoppers, Cotton Boll Weevil, Lygus Bugs, Ants, Colorado Potato Beetle, and many others! Have positive control of these economic pests with "VELSICOL 1068" Chlordane!

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If these little pigs could talk, they'd tell you that you *just can't beat a basic source of supply.*

When you deal with a Basic Producer like Pennsalt, you are sure of a dependable source of supply—because Pennsalt produces essential raw materials . . . processes them . . . and delivers the finished products to you at fair prices.

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And you're sure of dependable performance—because Pennsalt operates the extensive Whitemarsh Research Laboratories in order to *be sure* each product will perform properly under specific field conditions.

Don't take chances—handle a widely advertised *basic* agricultural chemicals line . . . the Penco* line produced by Pennsalt . . . to promote more sales . . . bigger profits, with less effort. For full details write to Agricultural Chemicals Division, Pennsylvania Salt Manufacturing Company, Philadelphia 7, Pa., Tacoma, Washington, Bryan, Texas.

*REG. U. S. PAT. OFF.

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AGRICULTURAL CHEMICALS

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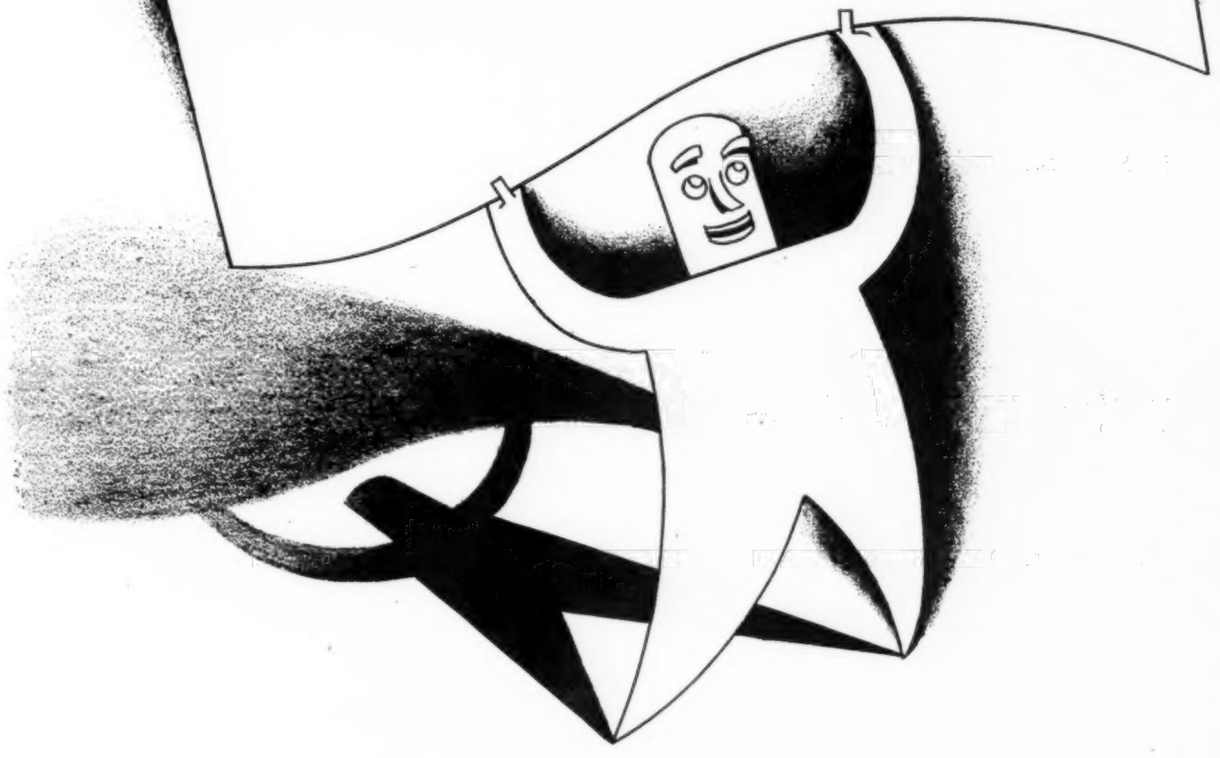
- Penco WB-50* Wettable Base 50% DDT
- Penco DB-50 Dust Base 50% DDT
- Penco Cattle Spray
- Penco Calcium Arsenate
- Penco BHC Technical—36% Gamma Isomer
- Penco BHC 12% Gamma Isomer both wettable base and dust base
- Kryocide*—*Natural* Cryolite
- Penco 2,4-D Weed Killers
- Penite* 6 Weed Killer (Sodium Arsenite)
- Penphos (Parathion)

DDT

DDT technical grade and concentrates are available in quantities for immediate shipment from manufacturing plants in Saint Louis, Michigan and Pine Bluff, Arkansas.

As one of the largest basic manufacturers of DDT, Michigan Chemical Corporation's specifications meet or surpass standards established by all governmental agencies.

Your inquiries will receive prompt attention.



MICHIGAN CHEMICAL CORPORATION, SAINT LOUIS, MICHIGAN

NEW YORK SALES OFFICE: 230 Park Ave., New York 17, N. Y.

STEP UP SALES! This Spring

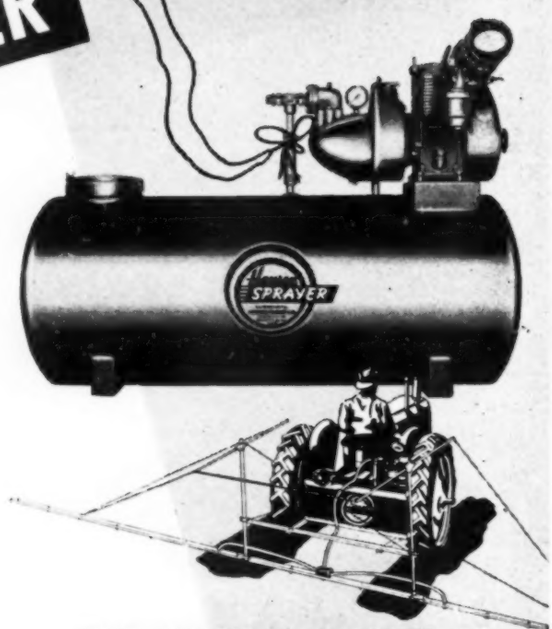
YES — SELL AGRICULTURAL CHEMICALS BUT ALSO SELL

The New HANSON SPRAYER

READY RIGHT NOW!

The farmer who buys agricultural chemicals is, naturally, the best kind of a prospect for the sale of an efficient sprayer And he wants it -- NOW!

The New Hanson Sprayer, ready now, is designed and engineered to spray any solution, heavy or light, by the use of interchangeable nozzles to fit the Hanson Spray booms. Then, the Hanson Sprayer is the only spraying unit with one moving part -- the pump impeller. This means that service and repair worries are held down to a bare minimum.



THE HANSON SPRAYER

The HANSON is the only spraying unit with ONE MOVING PART -- which means repair worries and service costs are held down. Hanson Booms come in 13½, 20 and 30-foot widths, for any type of spraying job. Made of non-corrosive metals with maximum rigidity, minimum swaying. Leakproof, hinged to fold up no wider than the average farm vehicle.

A "natural" for the implement and agricultural chemical dealer! The new Hanson Sprayer is now available in quantities for the coming spraying season. Remember, the HANSON is an all-purpose sprayer, easily attached to tractor, jeep, truck or trailer.

Dealers: Write Immediately for Complete Information

HOWARD HANSON & CO.

BELOIT, WISCONSIN

A survey made last month of the state recommendations for rat control indicated that 95% mention and recommend the use of red squill in substantially the following words:

> "Red Squill is the safest bait for use by the general public. * * *
>
> "Red squill (powdered) should be mixed at the rate of 1 part squill to 9 parts bait. Be *sure to obtain squill with a guaranteed strength of at least '500 mg/kg'*. Red Squill is the safest of all rat poisons and is very effective when properly used."
>
> *(from "Fact Sheet," U. S. Department of Agriculture, Cooperating with Department of the Interior, Fish and Wildlife Service, November 1947)*

DETHMERS RED SQUILL POWDER and RODINE (liquid extract of red squill) assay 500 mg/kg, the new standard set up under the Federal Insecticide, Fungicide and Rodenticide Act.

This more potent red squill will serve in campaigns to reduce the rat population of the country which each year rats destroyed 200 million bushels of grain urgently needed overseas. The U. S. Department of Agriculture, cooperating with the Department of the Interior, Fish and Wildlife Service and assisted by local groups over the entire country, is planning a broad conservation program through rat control.

Please write us for information on how you can prepare to meet the demand for red squill which will inevitably result from the wide publicity to be given these conservation measures.

MERCK IS SERVING THE INSECTICIDE INDUSTRY AS A BASIC AND PRIME SOURCE OF SUPPLY FOR DDT

An aerial view of the Main Plant of Merck & Co., Inc. at Rahway, N. J.

Because of greatly expanded production and sufficient raw materials, we now are in a position to serve an increasing number of manufacturers of DDT insecticides.

The product we offer is—

DDT

TECHNICAL

(dichloro-diphenyl-trichloroethane)

Setting point 89° C. Minimum
For Manufacturing Purposes Only

Write us for prices and let us know your requirements. Please address your inquiry to the Insecticide Products Department, Merck & Co., Inc., Rahway, N. J.

DDT TECHNICAL

For the Manufacture of Agricultural, Livestock, Horticultural, and Household Insecticides

MERCK & CO., Inc. RAHWAY, N. J.

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MERCK MERCK

Now ..a Great *NEW* Market for

King Cotton finds a powerful new ally in Chlordane. Demonstrating the same revolutionary success in combating boll weevils that it has against grasshoppers, curculio, and other agricultural insects, Chlordane again proves its versatility—presents profitable market opportunities to formulators and their dealers.

The recently released South Carolina recommendation of Chlordane is based on the following facts: Chlordane, by *destroying the boll weevil in the square*, in addition to conventional kill of free-living weevils, prevents emergence of a new generation, thus reducing the number of insecticide applications heretofore necessary to obtain effective control of this pest. Chlordane also prevents aphid build-up and is effective in controlling such important cotton insects as tarnished plant bug, green stink bug, and cotton flea-hoppers.

Chlordane is compatible with dusting sulphur and DDT. Combination of these three complementary toxicants makes practicable the complete control of all major cotton pests with one formulation.

Technical Supplement #207, Chlordane for Control of Cotton Boll Weevil, is now available and may be had on request. Write us for complete information.

Julius **HYMAN** *& Company*

DENVER, COLORADO

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2,4-D

AVAILABLE under your own private brand name or our Stantox 2,4-D label

With 12 year's experience in the manufacture and field use of *selective* weed killers, we are now in a position to offer Agricultural Chemical Distributors or Processors a complete line of 2,4-D Weed Killers. All of our products have been thoroughly tested in practical field tests by our trained technicians and have been approved by all leading agricultural authorities.

STANTOX "70"

Dry 2,4-D (Sodium Salt)—In 1947, grain farmers all over the country reported excellent results in the control of annual weeds with Stantox 2,4-D dusts and sprays. With more and better spraying and dusting equipment now available, this market is bound to increase many times over.

STANTOX "66"

2,4-D (Liquid Amine Salt)— This liquid 2,4-D concentrate is very popular because it can be used in low volume spraying. Its complete water solubility makes it an easy, economical spray for selected killing of broad-leaved annual weeds in certain crops and lawns. Thousands of acres of small grains, rice and corn were commercially sprayed by ground rig and plane using a volume of 5 to 10 gals. of Stantox "66" 2,4-D spray per acre.

STANTOX "P-44"

2,4-D (Isopropyl ester of 2,4-D)—To round out the Stantox 2,4-D line we offer Stantox "P-44" for "hard-to-kill" woody perennials and mature weeds. Here again, the action is "selective", as Standox "P-44" clears weeds from pastures, irrigation ditches, roadsides, etc., without affecting the desired grasses. It also can be used for low-volume spraying on corn, rice and small grains.

2,4-D
ACID
SODIUM SALT
ISOPROPYL ESTER
TRIETHANOLAMINE SALT

OBERDORFER BRONZE PUMPS

NORTH AMERICAN *Standard* ...

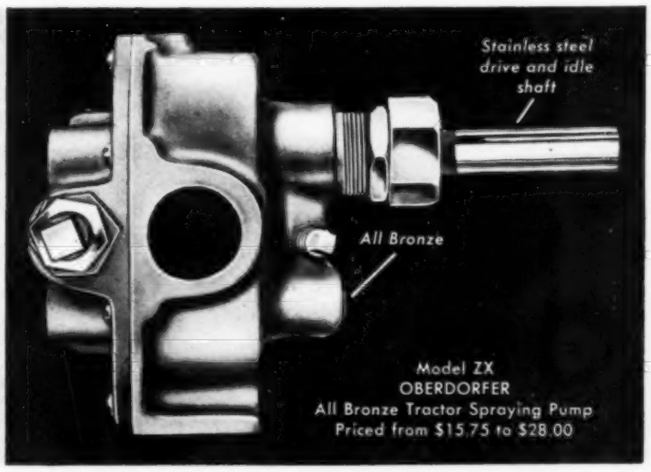
for weed spraying equipment

During the past year qualified members of this organization have travelled over one hundred and fifty thousand miles to determine the extent of use and the effectiveness of Oberdorfer Bronze rotary gear pumps in spraying the many commercial chemicals used extensively for Weed Control on outstanding farm crops throughout the United States and Canada.

Hundreds of men interested in spraying development were interviewed: Farmers, County Farm Agents, Weed Commissioners and Farm Equipment dealers; State, Federal, Provincial and Dominion agricultural specialists; many members of several of the great commodity exchanges as well as manufacturers of both chemical sprays and spraying equipment.

Using the opinion of the above group of men as our authority, we say to you that Oberdorfer Bronze Rotary Gear pumps should be on the equipment used to spray most of the acreage in the United States and Canada. Based upon our present rate of production of these inexpensive pumps, we advise you that no piece of spraying equipment need be built without the many advantages afforded by the Oberdorfer Pump.

If the Oberdorfer Bronze Pump is on your spraying equipment you are using the North American Standard, according to the men who know spraying pumps. *The Oberdorfer name is cast on every Oberdorfer Pump.* There is no substitute.



1. No corrosion with bronze and stainless steel.
2. Pressures up to 150 pounds per square inch.
3. Built-in adjustable pressure relief valve.
4. Lower cost than iron of similar design.
5. No priming to 15 feet below pump.
6. Four large Alemite lubricated bearings.
7. Easily installed by any mechanic.
8. ¼", ⅜", ½", ¾" and 1" standard pipe connections.
9. Backed by 50 years of bronze pump manufacturing.
10. All metal — no rubber.

Oberdorfer Foundries, Inc., Agricultural Pump Division

5100 Thompson Rd. — Syracuse, N. Y.

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Tobacco fleabeetle,
Epitrix parvula.
Approximately 40 times natural size

SANTOBANE

(Monsanto CBT)

Exhaustive tests have proved proper formulations of Santobane effective against all four major insect groups—household, premise, animal and agricultural. Furthermore, it kills in two of the three possible ways—1. As a stomach poison; 2. As a contact poison.

Formulators of insecticides prefer to work with Santobane because of its uniform, free-flowing, granular characteristics which permit it to be easily solubilized, emulsified or milled.

Further information and technical data are available in a new Monsanto folder on Santobane. For your copy, write to MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri, or return the convenient coupon.

Santobane Reg. U. S. Pat. Off.

SANTOBANE SPECIFICATIONS	
Physical form	Fine granular powder
Color	White to cream
Setting point	89° C minimum
Organically bound	
Chlorine (% by weight)	48% minimum to 51% maximum
pH of water extract	6.0 minimum to 8.0 maximum

News of Monsanto Chemicals for Insecticides, Herbicides and Fungicides... February, 1948

NIFOS-T controls insects and mites

Nifos-T (Monsanto Tetraethyl Pyrophosphate, Technical) is effective against many of the mites, aphids and thrips which cause enormous annual losses in orchards, farms and greenhouses. Containing 40% tetraethyl pyrophosphate, Nifos-T possesses 3 times the biological activity of commercial hexaethyl tetraphosphate. It can be applied successfully in sprays, aerosols or dusts.

Nifos-T is economical to use because of the low concentrations needed for effective control of insects and mites. A contact-killer, Nifos-T does not cause problems in residual toxicity and is compatible with most other compounds used in insecticidal formulations.

Complete application and technical data on Nifos-T are now available. Write to Monsanto, or use the convenient coupon if you prefer.

SOME FARM, FRUIT AND GREENHOUSE PESTS SUSCEPTIBLE TO NIFOS-T — MONSANTO'S TETRAETHYL PYROPHOSPHATE

Two-spotted spider mite	Cotton or melon aphid
Pacific mite	Spirea aphid
Citrus red mite	Cabbage aphid
Cyclamen mite	Black pecan aphid
Greenhouse thrips	Pea aphid
Codling moth (larvae)	Rose aphid
Leafrollers	Chrysanthemum aphid
Melonworm (adults and larvae)	Green peach aphid
California oakworm	Walnut aphid
Southern Army Worm	Mealybug
Pomace fly	Scale insects (crawlers)
House fly	Soft scale
Leafhoppers (nymphs)	Citricola scale
Pear psylla	Black scale

DEATH ON WEEDS

2,4-D

2,4-D Sodium Salt

Farmers no longer complain that their largest crop is WEEDS. Monsanto's 2,4-D and 2,4-D Sodium Salt, when properly formulated, now provide an economical method of controlling plants which drain the soil of valuable water and nutrients needed for healthy crops.

2,4-D is selective in its action, a property which makes it an ideal weed-killer. Monsanto furnishes both insoluble 2,4-D Acid and 2,4-D Sodium Salt, which is water-soluble. Formulators and processors are invited to write regarding their requirements.

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Please send me further information and technical data on
Santobane ☐; Nifos-T ☐; 2,4-D ☐

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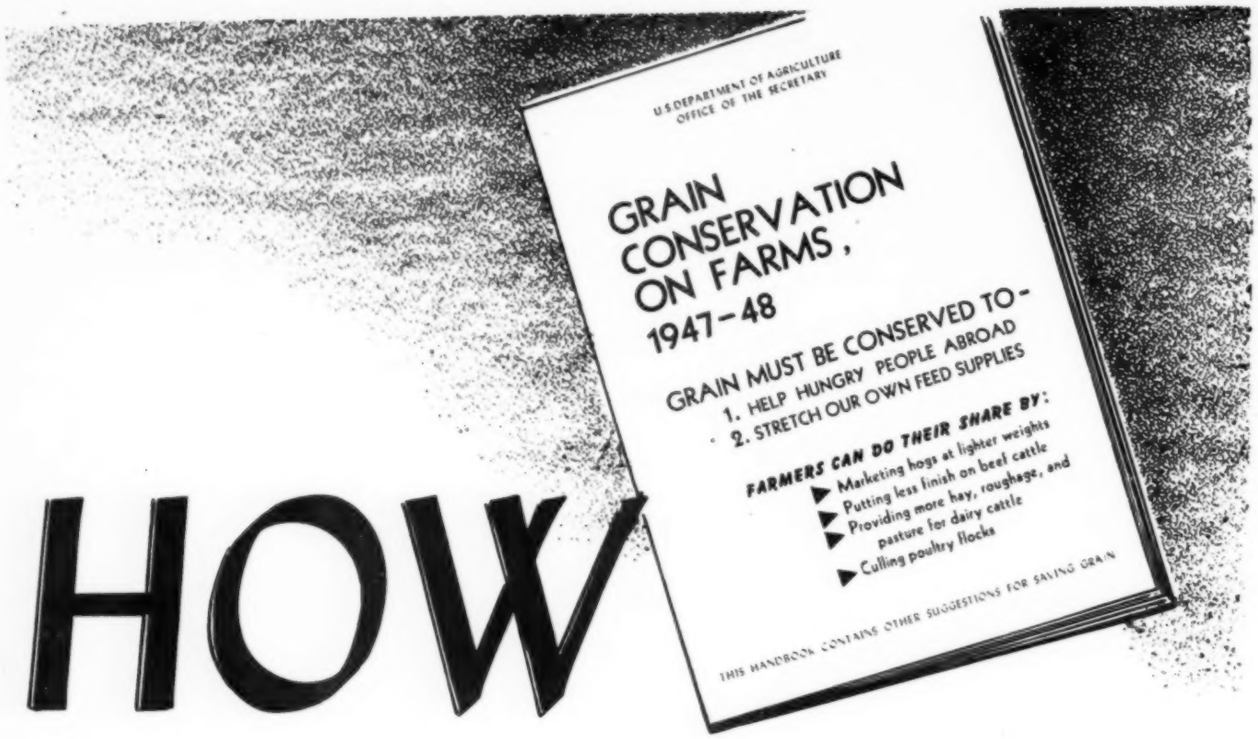
U.S. DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
GRAIN CONSERVATION ON FARMS, 1947-48
GRAIN MUST BE CONSERVED TO-
1. HELP HUNGRY PEOPLE ABROAD
2. STRETCH OUR OWN FEED SUPPLIES
FARMERS CAN DO THEIR SHARE BY:
Marketing hogs at lighter weights
Putting less finish on beef cattle
Providing more hay, roughage, and pasture for dairy cattle
Culling poultry flocks
THIS HANDBOOK CONTAINS OTHER SUGGESTIONS FOR SAVING GRAIN

HOW YOU can help this government program

The Anti-Inflation Bill just passed by Congress directs the President, through the Department of Agriculture, to carry out a program for the conservation of food and feed.

You, as an insecticide manufacturer, can help this program by pushing your products and your know-how for the control and eradication of insects and rodents.

The Powell Company, as basic manufacturers of insecticide, rodenticide and weed control materials, can help you help this program. We offer you all the cooperation that our quarter century of experience is worth. Our technical staff will help you in selecting materials. Our sales staff will help you to promote them.

Among the Powco Brand products you should use and promote in this program are:

- Cattle grubs — Cube Powder
- Rodent Control — Antu
- Poultry lice, ticks, etc. — BHC (Benzene Hexachloride)
- General Insect Control: Animal parasites, stored grain insects, cattle insects, agricultural insects nuisance insects, etc.
  - PYRIN #20
  - BHC
  - JP-25 (25% DDT emulsion)
  - JP-30 (30% DDT oil soluble)
  - JP-50 (50% DDT powder)
  - JP-50W (50% DDT wettable powder)
- Weed Control (cereals, corn, flax) 2,4-D

How the new government program can help YOU

The government will initiate a nationwide publicity program emphasizing the need to save grain and feed. Detailed literature, posters, recommendations and other forms of promotion will be in the hands of all State Extension Directors very shortly. In addition, the full cooperation of trade associations and other interested groups is being enlisted. Here's a great opportunity for Insecticide Manufacturers like yourselves to develop this program. What's more, you'll profit by its success.

Make your plans today and let us know how we can help you.

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THE EDITOR COMMENTS

LACK of food is the word's number one problem, according to a survey just completed by the United Nations. "The scarcity of food is the principal cause of the inflation spiral . . .", it reported. The February meeting of the Agricultural Insecticide and Fungicide Association in the nation's capital, tackles an important branch of the food situation—namely, the conservation of stored grains, and the protection of growing plants from insects and disease which destroy enough food in an average season to feed a large portion of the world's hungry.

It appears just now that chemical supplies for this wide production and conservation program will be available when needed, *if* orders are entered promptly. Enthusiastic backing of the U.S.D.A. program by suppliers of agricultural chemicals is currently seen in company publicity releases and advertising. Important as this is, the practical action by the dealer consists of deciding *now* as best possible, his requirements of the season, and placing orders without delay.

The supply may be thus well assured, and much confusion and disorder, if not downright shortages, may be averted at the critical period when materials are needed most urgently.

ASSURANCE that the fertilizer industry is prepared to assist America's farmers in meeting the higher food production goals urged by President Truman in his January 14th Annual Economic Report to Congress, was given by Maurice H. Lockwood, president of the National Fertilizer Association, in a recent statement. Although higher farm production schedules call for an increase of about ten percent, the farmers can accomplish this goal with the proper use of fertilizer, Mr. Lockwood said. He pointed out that fertilizer today accounts for about 20 percent of the annual food production in the U. S. "It is highly probable that this percentage attributable to fertilizer, will increase as fertilizer production continues to break records year after year," he added.

During 1947, approximately 16,500,000 tons of fertilizer were produced in the U. S.—an increase of about 2 million tons over the 1946 figures. Percentagewise, this increase was equally significant, amounting to 14%; a new all-time record. It is thus safe to look for an output of perhaps 18 million tons of fertilizer in 1948, assuming, of course, that there shall be no major difficulties develop in the way of strikes, raw material shortages, etc.

Mr. Lockwood said further, that "if farm prices remain at high levels and other factors are favorable, we will be able to increase further the volume (of fertilizer) at a rate of one million tons each year for the following two calendar years, thus reaching a volume of 20 million tons by 1950."

In the meantime, demand for fertilizer materials is expected to continue its upward trend. Prof. E. L. Worthen recently stated that users of fertilizer would do well to buy early. "If we move more fertilizer to our farms in the fall and early winter, the fertilizer industry can produce and deliver more tons than they can if we all delay buying until spring." Although it is obviously too late now to buy in early winter, there may still be time to beat the main clamor for materials, later this spring.

A POSSIBLE shortage of rotenone in 1948 is forseen by industry leaders close to the market. Because of uncertainty and confusion regarding the nature and extent of rotenone requirements this year, insecticide manufacturers throughout the country have been reluctant to make substantial purchases in advance. All of which results in ebbing imports, and a far-below-

normal harvesting of roots in producing countries.

The upshot is that actual availability of rotenone for 1948 is practically limited to supplies already in the U. S., and it is obvious that time will not permit supplementing these supplies to any appreciable degree this season by further imports. Furthermore, according to industry sources, "it is extremely doubtful whether these available supplies are adequate for the probable minimum demand," and the demand is likely to exceed this minimum.

According to one usually well-informed industry spokesman, illusions of super-abundant supplies and price weakness are "unreal," and do not reflect truly the actual situation. Insecticide manufacturers again are urged to order now if they would obtain adequate supplies. Stocks may not be available at "a minute's notice" for too long, and later may not be available at all.

AMPLE new spraying and dusting equipment will be available in 1948 to take care of the country's needs in the expansion of food production. Application of the necessary chemicals to control insect and plant disease damage in the accelerated pace of agricultural output will not be slowed by lack of dusting and spraying equipment. We have the word of the National Sprayer and Duster Association that the industry can and will meet the requirements of the increased food production program. Further, the Association states, the industry has increased its activity in cooperative research with federal and state agricultural agencies as well as with chemical manufacturers. The only potential brake on production, according to the Association, lies in the possibility of shortages in steel and tin plate.

Regardless of this possibility, the fact remains that the industry is aware of need for new and improved methods of application. Frank J. Zink, agricultural engineer for the N.S.D.A. comments that "New chemicals, such as DDT and 2,4-D, along with new equipment and a much greater usage of present equipment, point the way toward more positive control" of agricultural pests. The need expressed by experiment station people, by industry research men, by entomologists and plant pathologists is for improved application methods to keep pace with rapid advances in the development of toxicants. That application equipment manufacturers are also working with every facility toward this goal gives added impetus to the drive for success of the whole food conservation campaign.

FROM two west coast plant pathologists comes a suggestion that manufacturers of fungicides should make available to small-scale gardeners tablets of compressed dusts so that the user may have an accurate measure when it comes to mixing up his liquid for plant disease control. The need for greater accuracy in the application of fungicides, especially by the home gardener who invariably uses far too much, sometimes with disastrous results, lends merit to the idea.

The two scientists, Johnson and Campbell, both of Washington State Institute of Agricultural Sciences, who discuss their idea elsewhere in this issue, indicate that the average layman is confused when it comes to preparing a quart of 4-4-50 Bordeaux mixture, for instance, when the material is usually sold in 3 or 4 pound bags, intended to be used in formulating 100 gallons or more of spray. They point out that even agricultural advisors have difficulty in explaining to gardeners how to prepare small quantities.

Accuracy is of great importance in preparing fungicidal mixes, yet the usual means of measuring is by the "teaspoonful" which varies with individuals, and depends upon how tightly packed the powder may be. A gardener could use accurate weights, but obviously such means are not available in the average household.

Messrs. Johnson and Campbell report having compressed into tablet form several of the organic fungicides, basic coppers and sulfur which dispersed in cold water as well as an aspirin tablet. They agree that some research should be undertaken to determine the proper degree of compression, the best dispersing agents, and their proportion to give optimum results.

In view of the evident growing potential in "backyard" gardening and an estimated 20 million dollars to be spent for pesticides annually in this connection, the subject might warrant further investigation.

Role of Pesticides in Food Production Discussed at

AIFA WASHINGTON MEETING

Clinton P. Anderson

Secretary Anderson, a native of South Dakota, was educated at Dakota Wesleyan and the University of Michigan. His interest in things agricultural goes beyond his office, as seen in his ownership of an 800 acre irrigated farm near Albuquerque, N. M., and another 640 acre farm near Mitchell, S. D. During the 78th Congress he was named Chairman of the House Committee to investigate campaign expenditures for 1944, and in the next Congress, was named Chairman of the Special Committee of the House to investigate Food Shortages. In his second term in Congress, Mr. Anderson served on the House Appropriations Committee, and was elected to the Ways and Means Committee at the beginning of the 79th Congress.

IN recognition of the big job lying ahead in the field of food conservation, the Agricultural Insecticide and Fungicide Association planned to devote its entire two-day program to that subject during its meeting at the Statler Hotel in Washington, February 19 and 20. Scheduled to sound the keynote during the opening session of February 19, was United States Secretary of Agriculture, Clinton P. Anderson. Mr. Anderson was to discuss current problems in addition to his prepared talk.

To complete the over all picture from the standpoint of industry, Dr. Norman Van Stone, Vice-President of Sherwin-Williams Co., Cleveland, Ohio, was to follow Secretary Anderson. Other speakers scheduled for the morning program included Herbert W. Voorhees, director of the American Farm Bureau Federation, and president of its New Jersey Unit;

Carroll P. Streeter

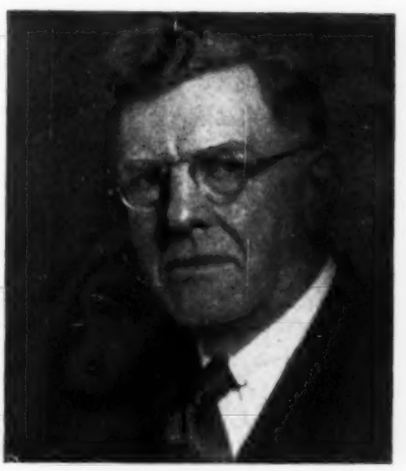
Mr. Streeter, managing editor of the "Farm Journal," is a native of South Dakota. He received his academic journalism training at Iowa State College from which he was graduated with the class of 1923. He later worked on the Cedar Rapids (Iowa) "Gazette," and later on "Farmer's Wife" magazine in Kansas City. He was recently awarded the Reuben Brigham honorary plaque for outstanding contributions to agriculture in agricultural journalism by the American Association of Agricultural and Industrial Editors.

Herbert W. Voorhees

Mr. Voorhees, in partnership with his father, operates a 400 acre farm in Mercer County, New Jersey. He is a graduate of the University of Pennsylvania, and as post graduate work, took a short course in Rutgers University, New Brunswick, N. J. Mr. Voorhees raises fine Guernseys, turkeys and other poultry, as well as certified seed. He is a member of numerous agricultural organizations, and is president of the "Free Farmers, Inc." as well as president of the New Jersey Farm Bureau and a director of the American Farm Bureau Federation.

S. A. Rohwer

S. A. Rohwer was born in Telluride, Colorado in 1888. Received his education at Colorado, and in 1909 became entomologist in charge of taxonomical investigations of the U. S. Department of Agriculture. This position was held by Mr. Rohwer until 1928, at which time he became Assistant Chief, Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture. He is president of the American Association of Economic Entomologists, and has held offices in a number of other scientific organizations.



Dr. C. J. Willard

Dr. Willard is agronomist at Ohio State University agricultural experiment station, Columbus. He was born at Manhattan, Kansas in 1889, and grew up in that state. He earned his Bachelor of Science degree from Kansas State College in 1908, and received further schooling at the University of Illinois and Ohio State. In 1917, he became assistant professor of farm crops at Ohio State, and remained in this position until 1926 at which time he became professor of farm crops. In 1933 he was named assistant agronomist at the Experiment station. He holds membership in a number of scientific organizations.

F. L. McDougall

Mr. McDougall is Counselor to the Director General of the Food and Agriculture Organization of U.N. He was born in London, England, in 1884, and studied chemistry in Germany. He went to Australia later where he engaged in irrigation fruit farming, and became chairman of the London Agency of Australian Dried Fruit Industries. In 1923 he was economic advisor to the Australian Prime Minister, and took part in the Imperial Conference and the World Conference of Monetary and Economic Affairs. From 1930 to 1939 he was Australian delegate to the League of Nations.

Wesley Hardenbergh

Mr. Hardenbergh was born at Youngsville, New York in 1894, was graduated from Columbia University in 1918. He soon afterward became editor of the Liberty, New York "Register," and from this post he joined the publications staff of the American Meat Institute. By 1928 he had worked up to vice-president, and in 1939 became president. He has a 200 acre farm near Lake Zurich, Ill., where he lives. He also owns another farm of similar size near Valparaiso, Indiana. On each of these farms he puts into practice the latest available food production and chemical pest control methods.

John Paul Jones, assistant to the Vice-President of Stauffer Chemical Co., New York; and Carroll P. Streeter, managing editor of the *Farm Journal*.

The program for Thursday afternoon included a talk by Robert C. Jackson, Washington representative of the National Cotton Council; and a forum under the leadership of S. A. Rohwer, assistant chief, Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, Washington. This forum was to feature representatives of the B.E.P.Q., Food and Drug Administration and other U. S. Agencies to discuss different phases of problems relating to food conservation.

Friday morning's session included a forum of radio farm program directors and talks by men close to the domestic and world food situations. F. L. McDougall, counselor to the Food and Agriculture Organization, United Nations; Wesley Hardenbergh, president of the American Meat Institute; and Dr. C. J. Willard, president of the North Central Weed Control Conference were all scheduled for talks during the morning.

Scheduled to take part in the radio forum were a number of representatives of eastern stations. This group was to include Don Lurch, director of agriculture for the Columbia Broadcasting System, Washington, D. C.; Tom Page, director of "Modern Farmer," WNBC, New York; Homer Martz, farm editor of station KDKA, Pittsburgh, Pa.; Ken Gapen, radio and video director for the U. S. Department of Agriculture; and Phil Alampi, farm editor of WJZ, New York.

Because the time of the A.I.F.A. meeting was too late in the month for complete coverage in this issue of AGRICULTURAL CHEMICALS, *in March we expect to carry further information about the meeting including excerpts from papers presented and reports on the symposia.*

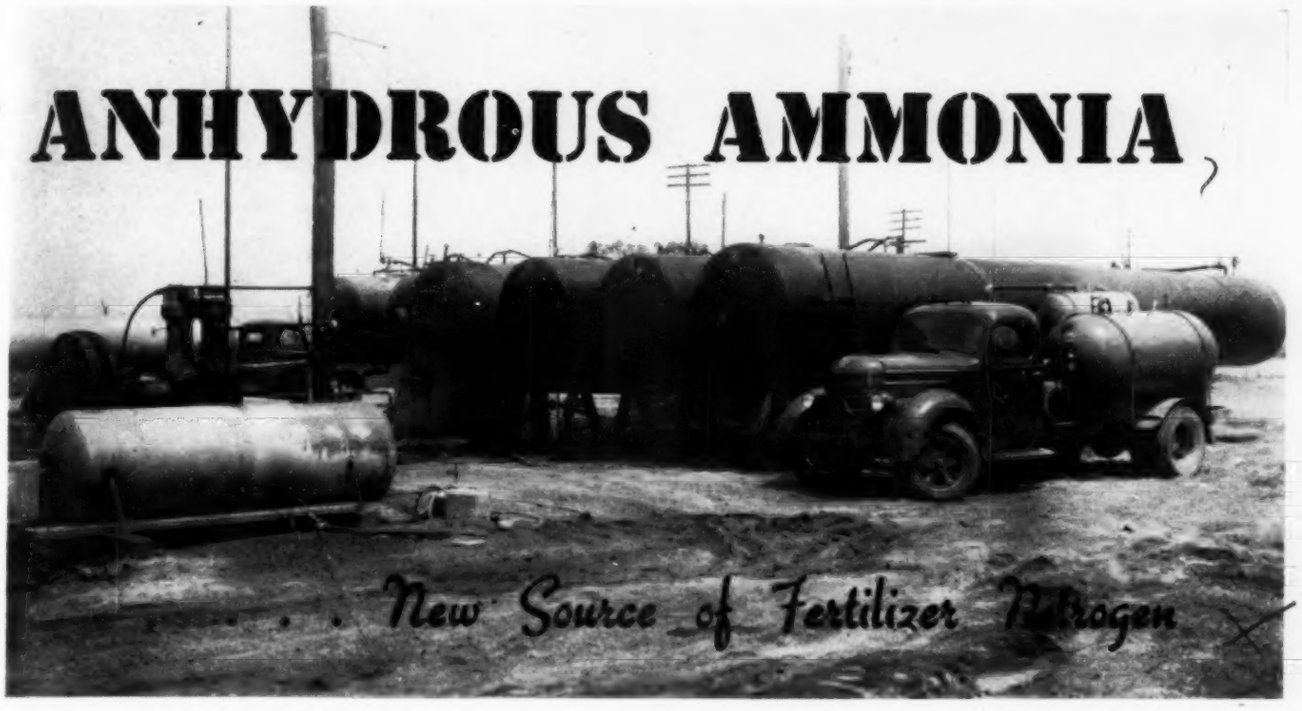
— Editor

Friday afternoon was to be devoted to a membership meeting in which industry leaders were to review the entire situation and discuss problems relating to the conservation of foodstuffs.

A number of industrial films were to be shown at the A.I.F. meeting. These were to include sound movies produced by the American Plant Food Council, Washington; Sherwin-Williams Co., Cleveland, Ohio; E. I. duPont de Nemours & Co., Inc., Wilmington, Del.; John Bean Mfg. Co., Lansing, Michigan; and the National Livestock Loss Prevention Board, Kansas City, Mo.

Lea S. Hitchner, executive secretary and treasurer of the A.I.F. Association stated that the meeting would probably attract the largest attendance of any convention in the history of the association.

ANHYDROUS AMMONIA



By Dr. W. B. ANDREWS
U.S.D.A., Beltsville, Md.

ANHYDROUS Ammonia was used over an extensive area during 1947, as a source of fertilizer nitrogen. Although recommendations and experimental data were not presented to farmers until in March of 1947, and equipment for application at that time was not available, yet more than 400 operators, all without previous experience, applied anhydrous ammonia to their soils without any serious accident. As a result, over 200,000 acres of corn and cotton were fertilized with the liquid last year.

Use of this material moved swiftly into the delta of Arkansas and Louisiana, and has since spread into the hill sections of Mississippi. It is also reported to be getting a start in Alabama, Florida, and some of the middle western states. The acreage to be fertilized with anhydrous ammonia during the 1948 season promises to increase many times over the amount used last season.

Successful application from the start was due to a number of factors. A shortage of solid sources of nitrogen was undoubtedly responsible in a large way for the immediate acceptance of anhydrous ammonia by a few enterprising growers. The success of these farmers with the use of the material acted as a springboard for hundreds of others to undertake this method of soil fertilization.

Equipment for applying ammonia was made ingeniously in local shops from the outset, and the ammonia itself was supplied to all who asked for it at that time. The equipment required to apply ammonia is estimated as being approximately $250 to $400 for tractor equipment, and from $500 to $600 for a 1080-gallon trailer tank. (These also had a place for use with butane or propane used in flame cultivation.)

Properties of Ammonia

Anhydrous ammonia is a gas which is compressed to a liquid for handling in commerce. Its pressure varies with temperature, and at 100°F. it has a pressure of 197 pounds.

When applied to the soil, ammonia combines with the clay and organic matter to form solids. It is necessary that ammonia be covered as it is applied to prevent its loss into the air. So long as nitrogen in the soil is in the ammonium form it is not leachable.

In fertile, well aerated soils ammonia is converted into nitrates within four to six weeks in warm weather. The rate of nitrification is slower in poor soils, wet soils, heavy soils, and during cold weather.

The factors which will determine whether or not anhydrous ammonia will be used when other sources of nitrogen are available are (1) cost; (2) adaptation to machine application; (3) adaptability to application on a service basis; (4) ease of application at a uniform rate and at the desired depth; and (5) crop response.

Anhydrous ammonia is the cheapest source of nitrogen available. The 1947 relative retail prices of nitrogen in Mississippi were:

Source	*Cost per Pound of Nitrogen*
Nitrate of Soda	17 cents
Cyanamid	13 cents
Ammonium Nitrate	10 cents
Anhydrous Ammonia	6 cents

The cost of anhydrous ammonia in the future will depend upon the length of the storage period, which will depend in time upon the demand for this product as well as upon seasonal use.

Machine Application

ANHYDROUS ammonia is transported to tanks mounted on trucks or trailers. Pulled behind a pick-up truck, a 1080 gallon trailer may contain 4,100 pounds of nitro-

Anhydrous ammonia fog produced when the liquid is released above the ground. Mechanical arrangements are made to close ground immediately after material is applied in furrow.

gen, which is equivalent to 25,600 pounds of nitrate of soda.

Anhydrous ammonia has been applied in a single operation on bedded or flat land before planting and in side dressing crops. It has also been applied in combination with listing land before planting, and is further adapted to application in the planting and cultivation operations, with only a minor reduction in the acreage which may be covered.

The tanks mounted on medium and heavy tractors hold (up to) 100 gallons of ammonia, containing 410 pounds of nitrogen, which is equivalent to 2,560 pounds of nitrate of soda. With an application of 41 pounds of nitrogen per acre, this quantity of nitrogen is sufficient for 10 acres.

A four-row tractor with one operator may apply nitrogen as anhydrous ammonia to from 40 to 80 acres per day, depending upon the speed and length of day. The ammonia is covered when it is applied.

Using the equipment available, two men with a tractor normally apply solid fertilizer to 20 to 25 acres per day; however, the acreage covered may reach 40 acres per day with some equipment now in use. In most cases solid fertilizers have to be covered in a separate operation.

On A Service Basis

A CONSIDERABLE acreage was fertilized with anhydrous ammonia on a service basis during 1947. With a 40 pound rate of application, the service charge, in addition to the retail price of the nitrogen, has been $2.60 to $3.60 per acre, which includes hauling the ammonia. The total cost of the nitrogen applied has been 12½ to 15 cents per pound. The cost of the equipment involved is $2,500.

If a tractor covers 40 acres per day the income is $144 per day, which is probably much more than the trade will tolerate under competitive conditions. If ammonia were applied for the difference between the cost of nitrogen as ammonia and ammonium nitrate, the cost for application of 40 pounds per acre would be $1.60 per acre, or $64 for 40 acres. This appears to be a good income from the equipment investment involved.

Ease of Application

THE uniformity of application is much greater than is usually obtained with solids. It is estimated that a careful operator may maintain the rate of application with a plus or minus five per cent during 95 per cent of the time without taking undue precautions. However, some uneven application has been caused because of failure to remove trash from the orifices.

The depth of application is limited only by the height of the lift of the applicators. When applied with the applicators attached to the cultivator frames, a six-inch depth is the practical limit. With equipment with a higher lift, deeper application may be obtained.

Crop Response

YOUNG cotton plants and particularly young corn plants prefer ammonia to nitrate nitrogen. When these young plants have ammonia available, they grow more rapidly than when only nitrate nitrogen is the source of nitrogen. Rapid growth of young plants facilitates cultivation.

Due to nitrification of ammonia in the soil, it is necessary to apply ammonia at or close to planting time if the ammonium stimulation is to be obtained. From this standpoint the application of ammonia in the planting operation appears to be ideal. In addition, applying ammonia in the planting operation would save one trip over the land.

Older plants prefer nitrate nitrogen. If ammonia were applied at planting time, it would supply young plants with ammonia and older plants with nitrate nitrogen, which appears to be ideal.

Response of Corn, Cotton

DATA reported for corn and cotton are for 32 pounds of nitrogen from anhydrous ammonia and ammonium nitrate. In twelve tests with cotton where ammonia was compared to ammonium nitrate during

Anhydrous ammonia application is accomplished at same time ground is cultivated with this device. In this particular operation, a side dressing to cotton is being applied.

two wet years, the following data was obtained:

Source of Nitrogen	Application Depth	Increase Yield Lb. Seed Cotton Per Acre
Ammonium Nitrate	4"	305
Anhydrous Ammonia	4"	386
Anhydrous Ammonia	6"	424

Statistically, the increase for ammonia over ammonium nitrate at the 4-inch depth of application is significant; however, in seven other tests of a different layout where the variations were quite high, ammonia was inferior to ammonium nitrate with the difference not being significant.

The reason for the superiority of ammonia in the above tests is not known unless it is associated with differences in leaching and with preference of young cotton for ammonia.

The 6-inch depth of application of ammonia was slightly superior to the 4-inch depth of application.

When nitrogen was applied as a side dressing in the twelve tests the following data were obtained:

Source of Nitrogen	Application Depth	Increase in Yield Lbs. Seed Cotton Per Acre
Anhydrous Ammonia	4"	330
Ammonium Nitrate	4"	350
Amomnium Nitrate	Surface	348

For side dressing in two wet years anhydrous ammonia and ammonium nitrate made practically the same increase in yield of seed cotton. Surface application of ammonium nitrate was just as effective in these wet years as a 4-inch depth of application, which contrasts sharply with the data for dry years reported below.

In thirteen tests with corn where ammonia was compared to ammonium nitrate at the rate of 32 pounds of nitrogen per acre in two wet years, data were obtained as recorded in the following column:

Source of Nitrogen	Application Depth	Increase in Yield Lbs. Seed Cotton Per Acre
Anhydrous Ammonia	4"	15.4
Ammonium Nitrate	4"	13.7
Ammonium Nitrate	Surface	12.8

Anhydrous ammonia was slightly superior to ammonium nitrate, and a 4-inch depth of application of ammonium nitrate was slightly superior to surface application. In five tests ammonium nitrate made the same increase in yield when applied before planting as when applied as a side dressing. Anhydrous ammonia made slightly more corn when used as a side dressing than when applied before planting; however, the difference is not significant. The 6-inch depth of application of ammonia produced one more bushel of corn than the 4-inch depth of application in eight tests.

Response on Dry Years

EXPERIMENTS conducted with ammonia and ammonium nitrate during the first year were side dressing tests. The ammonium nitrate was applied on the surface and plowed through with a tractor cultivator; while the ammonia was applied about 5 inches deep. The weather was very dry following the application of the fertilizer at most locations. The data for corn are reported in table 1:

Table I

The response of corn to anhydrous ammonia and ammonium nitrate on a dry year.

Test Number	Source of Nitrogen and Depth of Application: Anhydrous Ammonia 5 inches	Source of Nitrogen and Depth of Application: Ammonium Nitrate Surface
1	10.8	8.2
2	5.6	2.2
3	12.5	8.6
4	13.8	4.5
5	13.4	13.0
6	6.2	3.4
7	10.0	7.2
Average	10.3	6.7

The difference in favor of ammonia over ammonium nitrate for side dressing corn in the dry year is attributed largely to positional availability. The ammonia was applied deep enough for corn to get a reasonable amount of the nitrogen, while much of the ammonium nitrate remained in the surface where little moisture was present.

The data on the response of cotton to ammonia and ammonium nitrate in the dry year are reported in table 2.

The difference in favor of ammonia over ammonium nitrate for corn production in the dry year is attributed largely to positional availability. As was the case with corn,

(*Turn to Page* 77)

Chemical Control of CATTLE PARASITES

Eileen L. Donohoe & John Cowling
Donohoe Associates, Inc., and Mulhocaway Farm, Resp.

REPORTS of control methods against blood-sucking flies on livestock are almost commonplace now. Yet, there are new variations of the old tune brought about by the application of new insecticides to old problems. This article is a report of field work in which is set forth what was done, how it was done, and to what degree success was attained in the control of several common parasites of cattle. Insect pests found during the 1947 season on dairy cattle in northern Hunterdon County, New Jersey, where the tests were made, included the following species, in the order of diminishing individual numbers:

Horn fly, *Haematobia irritans* L., *Lyperosia irritane* L., and *Siphona irritans* L.

Stable fly, *Stomoxys calcitrans* L.

Horseflies:

"Greenheads," *Tabanus lineola* Fabr.

Black horsefly: *Tabanus atratus* Fabr.

Deer flies: *Chrysops* spp., only two individuals were observed, and these represented two species.

Certain limitations were imposed on the control procedure, since the measures were developed specifically for the local dairy farming industry. In the first place, the insecticidal materials and diluents used had to be harmless beyond question to the valuable animals treated, and to the operator making the application methods which of necessity had to be consistent with the practices of the dairy farming industry. Application had to fit in with farming procedures to avoid as much as possible disruption of the routine of the animals and farm personnel.

Materials and Equipment

ON the basis of limited tests in the 1946 season, it was observed that synergistic insecticides containing piperonyl cyclonene (formerly cyclohexenone) and pyrethrins and piperonyl butoxide and pyrethrins applied as water emulsions gave fly control on cattle for varying periods of time.

The work conducted during the 1947 season has been carried on principally, with a synergistic insecticide containing active ingredents: technical piperonyl butoxide 10% pyrethrins 1%, oily solvents and emulsifiers 89%, this concentrate to be diluted with water. Unless otherwise noted, all emulsions were quick breaking.

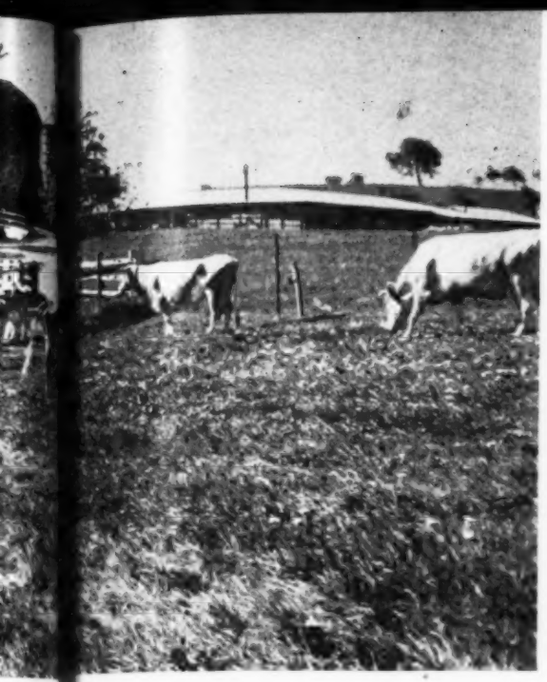
Hand sprayers were used in making applications. One type included several designs of the hand atomizer. The other type was a heavy duty, tubular tank compressed-air sprayer, equipped with 5 feet of hose manufactured by H. D. Hudson Manufacturing Company. Nozzles calibrated to deliver 0.2 gallon per minute and 0.1 gallon per minute at 40 pounds pressure in a flat fan-shaped pattern, manufactured by Spraying Systems Company, were attached directly to the shut-off valves.

All of the animals made available for these studies were working stock, that is, income-producing units on the farms of cooperators. Dairy cattle consisted of the Guernsey and Holstein breeds, and included calves, heifers of several age groups, pregnant cows, milking cows, and young bulls. Beef cattle were represented by the Aberdeen Angus breed only.

The horses which were under observation were pregnant mares in two pregnant-mare-urine production stables. Because these animals are especially trained, it was judged advisable to have the trainers apply the insecticide as they deemed best.

Basic Tests

FOLLOWING is a table summarizing tests which established a dosage giving fly control arbitrarily set as a countable number of flies, 6 to 10 individuals of all species on any one animal, 5 to 7 days after treatment. Subsequent applications were repetitions of Tests 3 and 4 to demonstrate the degree of variability in results which might occur in com-



mercial applications, and in these tests, a commercial insecticide known as Fairfield Laboratories' "Arfax Q B," containing 10% technical piperonyl butoxide, 1% pyrethrins, and 89% solvents and emulsifiers, was used.

In Tests 1 and 2, applications were made with compressed-air sprayers equipped with nozzles delivering 0.2 gallon per minute at 40 pounds pressure. There was considerable run-off, and it was thought that spray was being wasted. Tests 3 and 4 were made with nozzles delivering 0.1 gallon per minute at 40 pounds pressure with which complete coverage of the animal's body was attained using one pint of spray: this nozzle was used exclusively in all subsequent spraying.

Tests 1 and 2 represent first applications to two different groups of cows. The effectiveness of the insecticide terminated abruptly on the fifth day; this was consistently observed on all first appications made to dairy cattle whether the dosage was 1 pint or 1 quart of spray per animal. In the case of beef cattle, Aberdeen Angus, the first application broke sharply on the seventh day. The difference may be attributable to the fact that dairy cattle have short sleek coats and are cleaned and groomed daily before milking, while the beef cattle have thick woolly coats and are not groomed. All observations on fly infestations on animals were made in the form of pasture counts. The control animals for Test I had patches of horn flies, probably several hundred in numbers, on the forward part of the back and to a lesser extent on the head around the horns. The horsefly infestation did not average more than 1 fly per animal. The control animals for Test 2 did not have so heavy an infestation of horn flies; the patches were smaller and the flies were scattered, possibly numbering in the order of 200 per animal. Stable flies were numerous as compared with the Test 1 control animals; the animals had from 30 to 50, as an estimated average infestation.

In Tests 3 and 4 which represent second and third applications, the pasture observations of flies on the cattle indicated that stable flies returned first. On second applications, horn flies reappeared at the end of the week along with stable flies and horseflies. Following third and subsequent applications, stable flies would be present at the end of the week, but horn flies were rare or not in evidence. This might indicate that the repeated applications were building up a residue which was effective for longer periods against the horn flies or that the horn fly population in the pasture was being reduced. However, it was decided arbitrarily that when flies of all species numbered between 6 and 10 on any one animal, the application was losing effectiveness and another should be made. There was some question as to what the action of the insecticide on the flies might be. Flies which were on cattle at time of spraying and so were in direct contact with the spray were killed. During pasture observations, horn flies were seen to light on the cattle, then to drop to the ground, shortly after. Stable flies and horseflies were observed to light and immediately take flight without inserting the mouth parts; horseflies often were seen to approach a treated cow and then fly away without actually lighting. Since the purpose of this study was to arrive at a means of keeping cattle fly-free, no further consideration was given to the nature of the insecticidal action.

During the first four tests, climate conditions were recorded. By chance, Test 3 coincided with a rainy period, and Test 4, with a period of sunshine except for one heavy but brief rainstorm. The applications did not appear to be affected by either condition, and subsequent experimental and commercial treatments bore out this observation.

In Tests 3 and 4, the cows in the milking herd which did not receive an application by the pre-

Table I

Summary of fly spray applications using a quick-breaking emulsion made by combining 9 parts of water with 1 part of an insecticide concentrate containing 10% technical piperonyl butoxide, 1% pyrethrins, and 89% solvents and emulsifiers.

Test No.	Number of cows	Dosage rate per cow	No. days control	Climatic conditions: Rainy days	Climatic conditions: Clear days	Control animals
1	3 in herd of 14	1 qt.	5	4	1	Untreated cows (11) in herd heavily infested with horn-flies.
2	*14 in herd of 91	1 qt.	5	2	3	Untreated cows in herd (77) with moderately heavy infestation of horn flies and stable flies
3	*31 in herd of 91	1 pt.	7	6	1	38 heifers in adjoining pasture, moderate to heavy mixed infestation
4	*24 in herd.	1 pt.	7	1	6	As above

* The cows in Tests 2, 3, and 4 were part of the main milking herd. Test 3 includes the 14 cows of Test 2; Test 4 is short 7 cows, which were half of those individuals in the Test 2 group.

Systematic spraying of dairy cattle includes entire surface of animal, including udder and underline. Insecticide leaves no toxic residue.

cision method were sprayed with hand atomizers by the herdsmen. The same spray was used; the equipment and method were different. No special instructions were given except to agitate the sprayer frequently. The amount of spray applied to each animal was very small since a pint of emulsion might be used for a line of 40 cows. The control was moderately good, but the application was a daily chore.

Since in Tests 3 and 4 all of the cows in the milking herd were treated by one or another method, a herd of 38 bred heifers in the adjoining pasture was observed as a control group. These animals had clusters of horn flies estimated at several hundred on their backs and around their horns; and many had patches of flies around the navel. Horseflies were numerous as indicated by the welts, sores, and droplets of blood on the animals' bodies.

Other Tests

ONE farm followed the practice of putting the milking cows on pasture only during the cooler part of the day, from late afternoon until early morning. Since the flies seek a warm spot, the under sides of the cows were particularly heavily infested. These cattle were treated in the same manner as were those in other series except that only the lower half of the body was sprayed, using one-half pint of emulsion per animal. The results were consistent and comparable with those from other tests.

One herdsman used the 1.9 emulsion in an electric sprayer and got 4 days' control. Another used a continuous sprayer of the atomizing type and gave his cows an overall coverage every other day. He considered his control to be satisfactory.

Later in the season, the 91 cows in the milking herd of Tests 2, 3, and 4, were sprayed with a moderately stable emulsion made by combining 9 parts of water with 1 part of a concentrate containing 20% technical piperonyl butoxide, 1% pyrethrins, and 79% emulsifiers and solvents. The method and dosage were as in Tests 3 and 4. There was no marked lengthening of the period of effectiveness.

A herd of 17 cows was sprayed by the precision method with a quick-breaking emulsion which resulted from combining 1 part of the concentrate containing 10% technical piperonyl butoxide and 1% pyrethrins with 4 parts of water. The dosage was one pint per animal. Although the active ingredients in the emulsion were double the amounts in Tests 3 and 4, the period of effective control was lengthened to 9 to 10 days.

Application Methods

ALL dairy cattle, regardless of age and sex, were secured in stanchions for spraying, either preceding or following supplemental feeding and milking. At no time was there any disruption of the milking routine for the benefit of the spraying. The cattle were not held inside until the insecticide dried, nor were they kept in the barns because of rain.

On the basis of over one thousand treatments to dairy animals, the average time allowed for actual spraying of the cow is about three minutes, although a good operator can do the job in a minute and a half. Spraying procedure is worked out in a logical manner, beginning at the rear of the animal and working forward, with the entire area of the cow being treated before the job is done. After having sprayed five or six cows, the sprayer pump is compressed about 18 times to bring the pressure sufficiently high to empty the sprayer.

Comparison of Methods

WITH the milking herd of 91 cows, it was formerly the practice to apply an oil spray twice daily with a hand atomizer,—once after the morning milking and again in the afternoon before the second milking. About 15 minutes were allowed for each 40 cows. On this basis, the 91 cows would require approximately 35 minutes at each spraying. The last treatment of the season in mid-September applied to this same herd required 3½ man-hours, actual time for mixing and applying spray.

Using the estimated figure of 3 minutes per cow, the spraying time saved weekly over the former method was about 3½ hours. The time factor, of course, is influenced by the skill of the operators, the behavior

of the animals, and the width of stalls.

Beef cattle were sprayed while confined in a "squeeze" or chute, with two operators, one on each side, making the application. These animals were given the same coverage as dairy cattle by spraying between the planks and over the top of the structure. In the first application to 30 head, the total time was 1 hour 45 minutes with three people employed.

Effects on Cattle

THE physiological effects of fly sprays upon cattle have been studied by others. Although the herdsmen and the veterinary adviser could observe no external symptoms of ill effects following repeated sprayings (some groups had as many as six applications) with water emulsions of piperonyl butoxide and pyrethrins, it was decided to check body temperatures. This was done at 24-hour intervals just after the cows were brought in from pasture. There was no significant difference between sprayed and unsprayed cows, and no difference from day to day.

With the dosage of one pint of water emulsion which consisted of 1 part insecticide concentrate and 9 parts water, each cow received about 3.2 technical piperonyl butoxide, 1% pyrethrins, and 89% solvents and emulsifiers of an oily nature, the actual oily substance in each dosage of 1 pint emulsion per animal, would be about 2.85 tablespoonfuls.

There was no fluctuation in milk production which could be correlated with the application method, the spray, or the fly-free condition which resulted. Milk production is influenced by such a complexity of factors that, under field conditions, it was impossible to evaluate the fly control applications. In California, Freeborn, Regan, and Folger studied the effect of fly infestations on milk production, and attributed a 14 per cent loss to a mixed fly infestation. In New Jersey, the dairy industry is geared to high production. The cows are fed generously, the ration for each cow being directly correlated with her production records. Under these conditions, it is doubtful that even a very heavy fly infestation would affect milk production since the feeding is plentiful enough to offset this additional drain.

The loss of blood due to horsefly attacks has been studied in Nevada and Minnesota. On the basis of the infestations in those regions, it was estimated that an animal in Nevada lost approximately a quart of blood every 10 days, and in Minnesota, the loss was almost a quart every 3 days. While the horsefly population in this part of New Jersey was not comparable with these records, the loss of blood from a mixed infestation must be considerable, and this blood must be replaced. Therefore, a part of the daily food ration of a fly-infested cow must be diverted to replacing the blood consumed by insects. This suggests further studies on the nutrition of dairy cattle from the standpoint of conservation of feed through control of blood-sucking ectoparasites, not only flies but also lice, ticks, and mites.

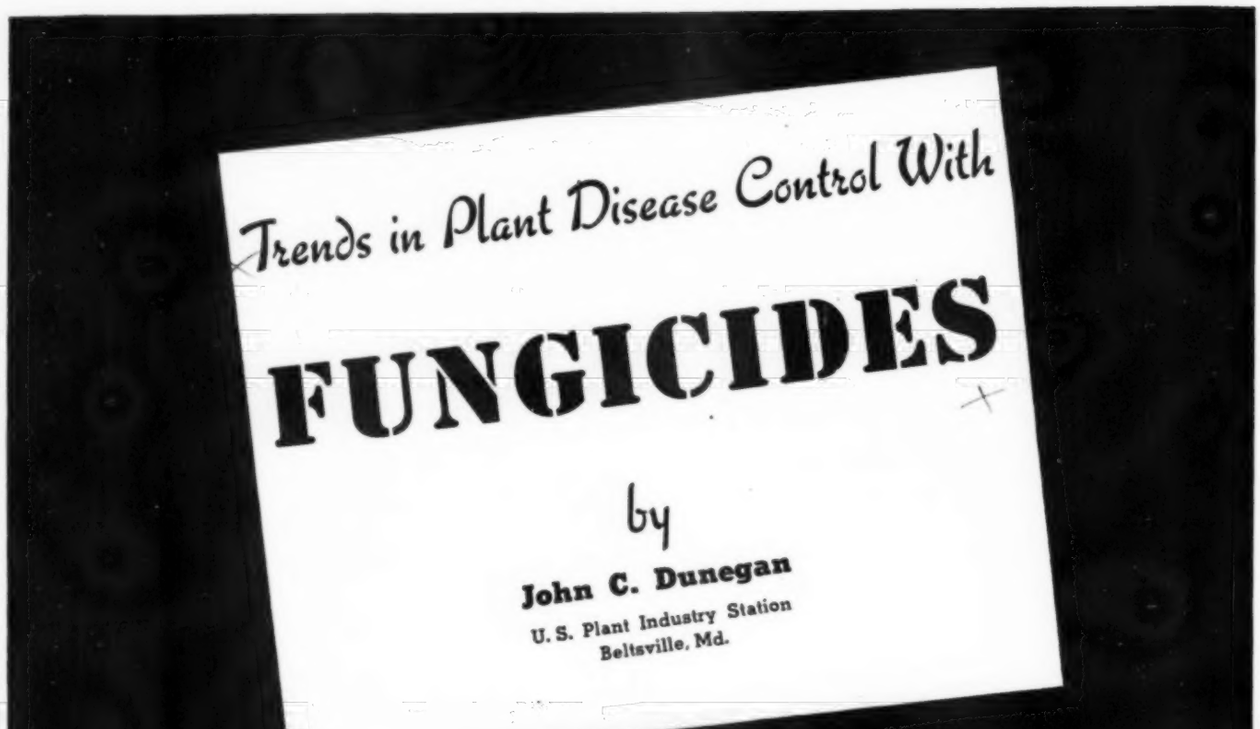
The most immediately noticeable effect of all applications was reflected in the behavior of the cattle. Restlessness was eliminated. Milking cows stood quietly and were more easily and pleasantly milked. On pasture, the animals did not move from place to place to escape flies, nor did they toss their heads, lick and kick at themselves, or even switch their tails.

All of the animals adjusted themselves to spraying operations rapidly. Milking cows are accustomed to contact with human beings and gave almost no trouble when sprayed in their accustomed places using the low pressure precision method. The spray produced felt to the hand like a cool, fine, gentle rain. On the first treatment, not more than 3 or 4 cows kicked when the legs and bellies were sprayed, and they were quite docile during subsequent applications. It should be noted that spray was not directed into the faces of the animals. Heifers and beef cattle which were on pasture continuously were uneasy during the first application. With the second and subsequent applications, they became increasingly cooperative.

In the second phase of the work, following the establishment of the 7-day fly-free period, two herds consisting of 91 milking cows and 36 heifers, respectively, were sprayed regularly once a week until the end of the fly season. The heifers which

(*Turn to Page* 74)

Flies congregate on areas which can be reached by neither tail nor nose of animal. Thorough spraying job must include all such spots.



PLANT pathologists have reached the point in disease control work where further advancement is predicated on the *project* type of research. This is truly a day of project science; not classified science. The solution of problems which now loom in plant disease control will be possible only through the coordinated efforts of plant pathologists, chemists, engineers and other workers in industry. This paper will comment upon the interrelation of interests in present-day trends in materials, machinery and control procedures as related to the writer's specialized field—the control of deciduous fruit diseases.

As noted in the recently summarized results of nationwide fungicide tests, there is a widespread interest in the use of organic materials as fungicides. The interest, however, is not restricted to finding a panacea, but rather in locating specific compounds for given diseases. When it is demonstrated, as was done in Oregon during the past three years, that an organic compound gives control of pear scab equal to that obtained with any form of elemental sulfur, with no deleterious after-effects, plant pathologists feel that progress is being made in a definite manner.

The trend, therefore, is toward *specific organic compounds* for the control of *specific diseases*. What progress has been made? We have mentioned pear scab control in Oregon, where ferric dimethyl dithiocarbamate is now considered the specific for pear scab, with an estimated increase of 300,000 boxes of Anjou pears each year. Other results might also be cited in this connection; such as the demonstration by New York plant pathologists that this same compound has a specific action against the apple rust fungi. The use of 2,4-dichloro 1,3-naphthoquinone as a specific for severe outbreaks of bitter rot is another instance, and the phenyl mercury compound for apple scab is still another. There has also been successful use of ferric dimethyl dithiocarbamate for blotch control, to eliminate the danger of copper russeting. Progress in the control of pear scab and various apple diseases with specific compounds has been most encouraging, although the same can not be said regarding control of peach disease.

A new compound to supplant elemental sulfur for more efficient brown-rot control is greatly to be desired. Likewise, there is the ever-present bacterial-spot disease, which is held under commercial control only by prodigious efforts, when a really effective non-injurious bactericide might eliminate the need for the half-dozen or more spray application schedule which must be prescribed at present. An effective remedy for

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—Paper delivered at the Fungicide Colloquium, American Phytopathological Society, Chicago, December 29, 1947. The author is senior pathologist, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. D. A.

pear blight might mean the reestablishment of the pear industry in the east.

It is the responsibility of plant pathologists to determine which materials are best employed for specific diseases, but the chemical industry can assist materially by orienting its research programs to the production of new compounds likely to be suitable to these specific needs. There is, for example, an urgent need for new compounds effective against bacterial diseases of plants.

It must be emphasized, however, that once a specific compound has been introduced and found to be satisfactory, it is the major responsibility of the chemical manufacturer to see that a uniform product is maintained from year to year. This may be a difficult assignment, but it is certainly a definite necessity if experimental tests are to furnish the basis for recommendations to growers and if the growers are to use the products with full assurance of uniform results.

Ten or 15 years ago it would have been necessary to cite a further responsibility for the chemical manufacturer—the need for adequate testing before releasing new compounds. This situation is less acute now. Practically all of the large manufacturers have their own testing staffs; and since they realize the potential value of a new compound which, for example, might furnish better control of the peach brown rot fungus, they do their own preliminary testing to protect proprietary rights. The result is that by and large experiment stations are not flooded with wholly untried materials.

Labor Saving Seen

BEGINNING before the war, but gaining momentum under the impetus of labor shortages and high wages, there is an unmistakeable trend toward the replacement of the spray crew with automatically directed nozzles of various types. The speed sprayer was probably the first of these modern machines, and it has been followed by various types of spray booms and towers, the current models of mist blowers, fog machines, and adaptations of the aeroplane and helicopter to the delivery of spray fluids.

Is this trend a desirable one? Upon careful analysis, it does appear to be. Although these mechanical devices may or may not lay down as thorough a coverage of fungicide as that obtained by expert spray hands, this disadvantage is offset by the machine's ability to cover an orchard rapidly and to allow a return for second applications in critical periods. In this way, much less time passes between applications than was hitherto possible. In fact, this trend opens a new approach to the control of fruit diseases. A number of experiments are under way in which a definite effort is made to reduce initial infections to the minimum by a series of sprays applied in rapid succession at the very beginning of the season. Using this scheme of multiple spray applications, very encouraging results can be reported in the control of peach blossom blight resulting from four applications made in a 10-day period.

When this reduction in time is accompanied by a similar reduction in the weight of the spray machines, a double advantage is gained. The continued movement of heavy machinery through orchards has a deleterious effect upon the physical structure of orchard soils, and the difficulties encountered in moving heavy equipment through water-soaked orchards are well known. This necessity often comes at the very period when timeliness of application is of critical importance. The development of the various types of lighter weight mist blowers, liquid dusters, and fog machines is therefore a trend which meets with the approval of the plant pathologists.

Continuing the idea of the project type research, it is necessary to call to the attention of engineers the need for more precise control over the discharge of materials in orchard spray and dusting equipment. Non-uniform discharge of dust due to "bridging-over" in the hopper and to makeshift delivery devices is the rule rather than the exception in present-day orchard dusting equipment. Frank Irons and his co-workers at the Toledo Laboratory of the Bureau of Plant Industry, Soils and Agricultural Engineering have shown that row crop dusters can be made much more efficient by proper attention to fundamental engineering details. It should consequently behoove the manufacturer of orchard equipment to make similar improvements.

The old idea that it is sufficient merely to drop the dust through a slot into the air blast can be disproved easily by any one who attempts to obtain uniform deposits of dusts on experimental trees. Such wide variations in delivery rate occur with present-day machines as to obscure effects of water and surface-active agents upon the deposition and subsequent weathering of dusts. Unless we can have more precise control over the delivery of dust, progress will be retarded in a field which many plant pathologists feel holds promise of being the ultimate solution to the problem of fruit disease control.

Changes in Methods

THE combination of new materials and new machines has resulted in changes in the method of applying sprays. Such changes may be characterized as a trend toward the substitution of an air blast for a jet of water as the medium to convey the active ingredients to the parts to be protected.

In this method, the dilute or concentrated spray material in a suitable liquid is pumped under pressure into a powerful air blast. The spray is conveyed by air to the trees at a rate directly correlated with the force involved in the production of the air blast. Machines with high velocity and low volume, or with low velocity and high volume are thus made possible.

The speed sprayers and mist blowers are good examples of this method. The liquid dusters are merely specialized forms in which liquid is injected into an air blast carrying the dry dust. Likewise, the down draft created by the rotor blades of

the helicopter added to the power of the duster is another specialized case. The main point to be remembered is that the fungicide is carried by the air blast into the trees and in the ensuing turbulence all parts of the plant are exposed and may be coated with a protective layer. The speed sprayers are already in extensive commercial use but they are heavy machines and the lighter weight mist blowers using concentrates requiring only minimum quantities of water are more representative of the present-day trend. If, as already mentioned, a more uniform flow of materials can be assured, there seems to be no reason to prevent their widespread adoption.

The use of liquid dusters, however, presents additional problems. It has been determined experimentally that the injection of moisture into the air blast carrying the dust results in a heavier deposit of active materials upon the leaves. At present there are a number of surface active materials that may be added to the water to enhance this deposition of the dust, but in the writer's experiments these materials appeared to be only slightly more effective than water. Probably each type of dust will have its special requirements and a whole series of experiments with surface active agents will have to be carried out before the most efficient combination is determined.

The demonstration that the load of dust deposited is greater when moisture is injected into the air blast does not solve the problems for there may be a clumping of the particles resulting in less of a protective coating than when dry dust is applied. Research on the liquid dusting procedure is one of the most urgent problems facing the fruit pathologist at the present time.

Fungicidal Aerosols

THIS discussion of trends would not be complete without some reference to the possible development and use of fungicidal aerosols. By definition, an aerosol is a suspension of a solid or liquid in a gas. Note that the definition carries no implication of any settling out of the components. Since we must have a deposition of active materials to gain protection against fungus infections of plants, there is some doubt that a true aerosol will be effective in this field. However, the term aerosol has also been used to denote preparations with particles large enough to settle and it is with this modified type that we are concerned.

Numerous physical problems arise with application of newer fungicides . . . much more research is called for in this field

The widely used aerosol bombs containing insecticides dissolved in a gas stored under pressure in a small metal cylinder are quite well known. The prerequisite for the preparation of an aerosol bomb is that the active ingredient must be soluble in the propellant gas or in some other material which in turn can be dissolved in the propellant. Our laboratory has as yet been unable to dissolve enough of the commonly used fungicides (sulfur, "Fermate" and "Phygon") to permit the use of these materials in an aerosol bomb. Moreover, many of the solvents used were found to produce injury to peach leaves. This reaction appeared to be correlated with certain exceptions to the boiling point of the solvent.

Since an aerosol is a suspension or solution of a solid or liquid in a gas, the problem has been attacked from another angle. Instead of having the material dissolved in gas under pressure in a cylinder, a finely divided suspension may be mixed with air and be carried as a fog-like mixture through the orchards by the normal air currents.

Aerosols of this type may be produced either by motor-driven blowers or by thermal generators. The lack of solubility of commonly used fungicides still interferes with the production of fungicidal aerosols by these machines but a more important difficulty must be considered. Except in the immediate vicinity of the machines producing these aerosols, there is no turbulence of the air currents. Since the aerosol is supposed to envelope the trees under the influence of the normal air movements, the question of adequate coverage becomes of paramount importance.

As used by the entomologist, these aerosols kill insects in flight from which it may be inferred that a very considerable proportion of the infestation to be controlled is present at the time the application is made. This is not the case with fungus diseases unless it is contemplated to have the aerosol at hand throughout the entire period of spore discharge. Moreover, fungus spores are carried by air currents and must germinate or die wherever they come to rest. If deposited upon a susceptible host, they will germinate and produce infection unless the part to be protected is coated with an almost continuous layer of fungicide.

Since it is assumed that once the aerosol is generated it will be carried by air currents through the trees, it becomes necessary to assume that in turn a layer of active material will be deposited on all the parts to be protected. There is no information available at present which proves an aerosol will make such a uniform deposition of material. In fact the evidence points to quite the opposite —namely, that the aerosol will not envelope thoroughly by mere diffusion and be deposited upon the upper and lower surfaces of the leaves or upon leaves and fruit surfaces protected by other leaves. This difficulty is one of fundamental importance as can be seen readily. It may prove to be the limiting factor in the use of this type of aerosol for the control of fruit diseases. The chemist and engineer have furnished us with new materials and machines—some with fascinating possibilities. It is the responsibility of plant pathologists to test these new tools and methods to obtain maximum results.★★

Fungicides in Tablet Form?

by

Folke Johnson and Lee Campbell*

RESEARCH workers and manufacturers of agricultural spray materials have not given adequate attention to the problems of the small, home gardener who needs only a quart or at most three gallons of spray at any one time. The amount of such chemicals used by the small-scale operator is of course not as great as in the commercial horticultural industries, but it is estimated on good authority that the potential annual market for small-package pesticides in the United States is about 20 million dollars.[1] Most spray powders are sold in 3 or 4 pound bags, intended to be used in formulating 100 gallons or more of spray.

Directions on the labeled material are usually confusing to the average layman who finds it difficult to convert to one quart or three gallons a recommended spray formula of 3 lbs:100 gallons of water. How many agricultural advisors have tried to explain to an average gardener how to prepare one quart of 4-4-50 Bordeaux mixture, or any of the other proprietary compounds reduced from a 100 gallon formula, to a similar quantity? Those who have will agree that it is difficult to accomplish.

The home gardener does not have weighing facilities for such small volumes, even if he had the ability to convert the formula with any reasonable degree of accuracy. In some cases, "tablespoon" measurements are given in manufacturers' directions, but this is inaccurate, since a "tablespoonful" varies somewhat with each individual, depending upon how much the material is packed. It is considered a crude and inaccurate method of weighing powder particularly when the right proportions of spray are very necessary to avoid phytotoxic effects. Most spray recommendations are prepared for larger-scale operations, which of course is not a reflection on the men who write the recommendations. It occurs because at present there is no easy method to prepare, accurately, small quantities of spray material except by using tablespoon or ounce measurements, or fractions thereof.

Would it not be desirable to compress the fungicidal dusts into tablet form, accurately weighed to a standard so that one tablet, "dissolved" in a certain amount of water —one quart for instance, will give the correct concentration, depending upon whether it is a dormant or summer strength? Wetting, sticking or dispersing agents in powder form can be incorporated with the fungicide before it is compressed. Bordeaux mixture could thus be prepared easily by dissolving in water a tablet of bluestone in a glass jar, the lime tablet in another, and then the usual procedure followed. This would result in a uniform, accurately prepared mixture on a small volume basis, without the usual messiness. In cases where some difficulty is encountered in compressing a certain fungicide into a tablet which will disperse quickly and give a uniform suspension when added to water, the material could be weighed up in small envelopes or capsules as used in the pharmaceutical industry. Liquid fungicides could also be held in either celluloid or plastic capsules with enough material to give the correct spray concentration for a quart or one gallon or more of spray.

The writers have compressed into a tablet form several of the organic fungicides, basic coppers, and sulfur. Fungicide tablets were prepared which dispersed in cold water with the same speed that an aspirin tablet dissolves. It is agreed that some research is required to determine the optimum degree of compression, the best dispersing agents, and their proportion in the mixture to give the best results. This method should also be applicable to insecticides used alone or mixed with fungicides.★★

For the small package market for home gardeners, two researchers suggest compressed tablets for more accurate use

* Associate and Assistant Plant Pathologists, respectively Institute of Agriculture Sciences, State College of Washington. P. O. Western Washington Experiment Station, Puyallup, Washington.

[1] A.I.F. News. 3:7. November, 1944.

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Comments....

By Dr. Alvin J. Cox

This column by Dr. Cox appears as a regular feature of AGRICULTURAL CHEMICALS. Dr. Cox formerly was successively Physical Chemist, Chief Chemist, Assistant Director, and Director of the Bureau of Science, Government of the Philippines. He was appointed Chief, Bureau of Chemistry, California State Dept. Agriculture in 1932, retiring in 1945.

So. California Entomology Club Meetings

EDITOR'S NOTE: *Last month this magazine reported the first part of the December 5th meeting of the Entomological Club of Southern California, held at Alhambra, Calif. In this issue is presented the report of the second part of the meeting, at which a number of new organic phosphate insecticides were discussed in a symposium under the leadership of Dr. A. M. Boyce, University of California Citrus Experiment Station, Riverside.*

FIRST speaker on the afternoon program was F. A. Gunther, University of California, who gave a brief history of organic phosphate insecticides, and the general chemistry of HETP, (hexaethyl tetraphosphate); TEPP (tetraethyl pyrophosphate) and parathion (O,O-diethyl O-p-nitrophenyl thiophosphate).

A colorometric method, developed by American Cyanamid Co., makers of parathion under the tradename "Thiophos 3422," is being used for residue studies of the material. The method is accurate to O.1 p.p.m. and reasonably good at O.O.1 p.p.m. About 400 determinations on various fruits (apples, pears, peaches, olives, grapes, avacados, walnuts, oranges, lemons and grapefruit) have been made already, and about a thousand more will be made on citrus from plots now in progress in the field. On the basis of present data, the Riverside station does not feel justified in drawing any conclusion regarding the residues of parathion, Mr. Gunther said.

Dr. Clinton H. Thienes, Dept. of Pharmacology, Univ. of So. Calif. School of Medicine, Los Angeles, in speaking of pharmacology and toxicology, pointed out that the organic phosphate insecticides have effects similar to those of physostigmine (eserine), which interferes with the action of cholinesterase in the animal body. He suggested that the toxic effects of these insecticides may be explained in part by this mechanism which interferes with the normal effect of nerves upon muscles and glands by inhibiting the destruction by hydrolysis of accumulated acetylchlorine at the nerve endings. Dr. Thienes also suggested that organic phosphate in insecticides may compete with the natural phosphates of the animal body in the enzyme-influenced reactions of carbohydrate metabolism, involving the combination of phosphorus with glucose. In this way normal chemical processes might be inhibited or modified.

Mite Control Studied

R. L. METCALF, Univ. of Calif. Citrus Exp. St., Riverside, reported on laboratory studies on insects and mites. Fifty esters of phosphoric acids and analogues have been proposed as insecticides. In general, ethyl esters are the most toxic; methyl esters hydrolyze too rapidly; and the toxicity of highest esters falls off too rapidly. The methyl esters may be of use where toxic residues cannot be tolerated.

On citrus red mite eggs, aqueous emulsions of technical parathion at 0.05 percent gave 100% kill, 0.02 gave 97% kill and 0.01 gave 80% kill. On citrus red mite adults and greenhouse thrip adults, technical parathion in acetone gave the following results:

Concentration of Parathion in %	Percent Mortality	
	Mites	Thrips
0.01	100	100
0.001	95	100
0.0005	82	100
0.00025	77	100

On California red scale adults and newly hatched crawlers, are seen in table I, page 39.

Roy E. Campbell, U. S. Bur. Entmol. and Pl. Quar., Alhambra, stated that in some small preliminary field trials, parathion 1% was as effective as chlordane and "Toxaphene" against cabbage caterpillars and more effective than cryolite. Against the pepper weevil in cage tests the immediate effect was almost the equal of DDT 10% or benzene hexachloride 2%, but its effectiveness after 5 and 10 days was much reduced. Joseph Wilcox stated that in preliminary tests in the Coachella Valley, parathion at 0.5 and 2% strengths appeared very effective against the white fly on eggplant.

C. C. Wilson, U. S. Bur. Entomol. and Pl. Quar., Sacramento, in absentia presented a paper on grasshopper control. "Toxaphene" (chlor-

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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Table I

Technical parathion in %, as aqueous emulsion	Percent Mortality Red Scale adults	Number of crawlers settled on fruit per adult female
0.01	84	0
0.005	23	0
0.0025	34	0
0.001	3	0
0 0005	0	0
"Thiophos 3422" wettable powder (parathion 15%) in grams per liter of water		
5.	100	0
2.	74	0
1.	35	0
0.5	15	0
0.1	1	0

inated camphene) and parathion compared favorably with presently used materials against *Melanoplus differentialis* on alfalfa and against *Melanoplus marginatus* on Ladino clover. One-half pound of technical parathion in 50 gallons water sprayed on one acre afforded satisfactory control of these two species of grasshoppers.

Leslie M. Smith, Univ. of Calif, Davis, made an interesting progress report on research underway in the Department of Entomology and Parasitology. The results at present are preliminary and the final results will be published later. It appears that HETP controls soft-bodied insects including the woolly apple aphid and the walnut aphid; and that parathion is effective against pea aphid, green peach aphid, walnut aphid, olive parlatoria, Pacific mite, Willamette mite, prune bud moth, early apple aphid, and various greenhouse pests, but shows little promise against pea leaf miner, grape leaf hopper, green sharpshooter, pear bud mite, grape bud mite, grape leaf folder, and lygus bugs.

M. M. Barnes, Univ. of Calif. Citrus Exp. Sta., Riverside, in discussing studies on deciduous fruits in southern California, stated that HETP and TEPP are not as promising as parathion for the control of woolly apple aphid and of mites on pome fruits. TEPP injured fruits at effective concentration.

"Thiophos 3422" wettable powder (parathion 15%) used at 1 pound per 100 gallons water was 95% effective against woolly apple aphid. On two-spotted mite on apples, typical results are seen in table II, this page.

A program of 4 cover sprays each containing "Thiophos 3422" wettable (parathion 15%) at 3 lbs. per 100 gals. water afforded effective control of codling moth on apples in an orchard that was heavily infested last year. This program gave very effective control of the clover mite.

Parathion residues are highly toxic to oriental fruit moth. "Thiophos 3422" wettable (25% parathion) was applied at 3 lbs. per 100 gals. water, and after the residue had weathered in the field for seven days it killed 100% of newly hatched oriental fruit moth larvae. The residues were 45% efficient after 28 days of weathering. A deposit of 0.2 micrograms per square centimeter afforded 100% kill of the newly hatched larvae. No injury was observed during these experiments from parathion on apples, pears, or peaches.

Walnut Pest Control

IN the absence of J. C. Ortega, Univ. of Calif. Citrus Exp. Sta., Riverside, Dr. A. M. Boyce told of the studies on walnuts in southern California. HETP and TEPP are both effective when applied as sprays in control of the walnut aphid. TEPP dust is also effective but HETP dust was not consistently effective. One percent parathion dust applied at the rate of 50 lbs. per acre was effective.

A program of two sprays each containing "Thiophos 3422" wettable (parathion 15%) at 3 lbs. per 100 gals. water gave highly effective control of codling moth in an orchard that was heavily infested last year. Excellent control of the walnut aphid, the two-spotted mite and the European red mite was also obtained in these plots. In heavy infestations of the two-spotted mite, following use of DDT for codling moth control, single treatments of parathion dust at 1% and 2% were not effective; nor was any other acaracide effective when used under these conditions. Two dust treatments each with 2% parathion dust used at 4 lbs. per tree showed promise in the control of walnut husk fly.

W. E. Buckner, Saticoy Walnut Growers Ass'n., Saticoy, discussed field use on walnut aphid in Ventura County. Six hundred gallons of 90% HETP were used on 5,000 acres of walnuts. The material was diluted 7 pints to 250 gallons and applied by means of a speed sprayer. One operator, who was learned later to be allergic to many toxic substances, was made ill, temporarily, but there were no serious after-effects. Material that had been diluted more than two hours was not applied.

R. N. Jefferson, Univ. of Calif. at Los Angeles, presented a paper on *aster leaf miner* on field grown asters for cut flowers. "Thiophos 3422" wettable (parathion 15%) used at 2 lbs. per 100 gallons of water, showed promise in control

Table II

	Mite per leaf	
	Pre-treatment	8 days after
"Thiophos 3422" wettable (parathion 25%) at ½ lb. per 100 gals. water	40	1
The same at 1 lb. per 100 gals. water	40	0
Untreated check	40	40 to 50

On Pacific mite on pears, typical results are as follows:

Material added to 3rd and 4th cover sprays of DDT	Number of leaves dropped per unit area
"Thiophos 3422" wettable (parathion 15%) at 1 lb. per 100 gals. water	39
The same at ½ lb. per 100 gals. water	47
The same at ¼ lb. per 100 gals. water	198
"DN-111" at ¾ lb. per 100 gals. water	64

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Celite SSC	Light pink	Maximum 5% on 150 mesh	6-8 microns	Max. 1%	210	190	9	17	2.15
Celite HSC	White	Maximum 7% on 150 mesh	7-9 microns	Max. 1%	220	180	10.5	17	2.30
Snow Floss	Light buff	Maximum 0.5% on 325 mesh	1-2 microns	Approx. 4%	210	185	8	24	2.00
Super Floss	White	Maximum 0.5% on 325 mesh	2-4 microns	Max. 1%	150	120	9	28	2.30

*Gardner-Coleman Method—lbs. of liquid per 100 lbs. of Celite. **lbs. per cubic ft.

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of this pest. Typical results from this treatment were: average of one miner per stem in the treated area compared to eleven per stem in the untreated plot. These results compared favorably with chlordane which was tested extensively. Erratic results were obtained with dusts. There was no injury from any parathion treatment on asters.

D. L. Lindgren, Univ. of Calif. Citrus Exp. Sta., Riverside, reported methods of control on insects attacking date plants. One percent parathion dust applied to bunches of dates in the field was not effective in control of nitidulid (date) beetles, nor was this treatment promising for control of the date mite. "Thiophos 3422" wettable powder spray showed promise for control of nitidulid beetles when applied on the soil of the infested date palms. Sprays cannot be generally used on account of water spotting of unharvested fruit.

Walter Ebeling, Univ. of Calif. at Los Angeles, said that parathion applied as wettable powder spray on avocados was highly effective in preliminary tests against soft brown and latania scale and citrus mealybug. Dusts also were effective on citrus mealybug and greenhouse thrips. No injury to trees was observed from any of the treatments.

Leo R. Gardner, California Spray Chemical Corp., Richmond, spoke on commercial usage in the west and dealt with hexaethyl tetraphosphate or tetraethyl pyrophosphate or tetraethyl peroxydiphosphate. These were the only materials used commercially in 1947. They are formulated for commercial use with organic solvents and wetting and spreading agents. Such formulations are compatible with most insecticides and fungicides except those containing lime or other alkaline substance. It was pointed out that the farmers had gained widespread commercial experience with these materials during 1947, and that based on this experience, results from these organic phosphates during the 1948 season should show further improvement. A very sizable volume of material has been used on many crops and pests in greenhouses, gardens and nurseries as well as on field crops. They have been used widely through special machinery such as vapo-dusters, aerosol generators and airplanes, at the rate of 1 qt. to 1 gal. per acre; in conventional power sprayers at the rate of 1 to 800 or 1 to 1600 parts water.

A. W. Cressman, U. S. Bur. of Entomol. and Pl. Quar., Whittier, reported on studies at the Whittier Laboratory. Parathion was quite toxic to red scale, but caused some leaf drop on lemon trees. Oranges were not injured. Sprayings made in October were still free from mites in December, but the intervening period is not yet long enough to judge ultimate results.

Outstanding Results

C. E. CARMAN, Univ. of Calif. Citrus Exp. Sta., Riverside, spoke on *armored scales* on citrus. HETP and TEPP are not promising against such pests, and little work has been done with them. Extensive field studies with parathion used as wettable powder suspended in water and as emulsions of various kinds are in progress against, red, yellow and purple scales on citrus. Results of most of these treatments will not be available for from 8 to 12 months following applications. The material shows promise as indicated by these results: "Thiophos 3422" wettable (parathion 15%) used at 1 2/3 lbs. per 100 gals. water gave 86% reduction of live adult red scale 60 days after treatment. The same material at 3 1/3 lbs. per 100 gals. water gave 96% reduction of live red scale 60 days after treatment. The same material at 1 2/3 lb. per 100 gals. water gave 70% reduction of live yellow scale 120 days after treatment. The same material at 3 lbs. per 100 gals. water gave 97% reduction of live yellow scale 120 days after treatment, compared with 84% reduction with light medium oil 2%. "Thiophos 3422" wettable powder appears to be in general fairly safe on citrus although occasionally there results from its use a substantial drop of older leaves. The personnel involved in making field applications during this season have not experienced any acute or chronic toxicities as result of their repeated exposure.

W. H. Ewart, Univ. of Calif. Citrus Exp. Sta., Riverside, discussed field studies of *citrus thrips* and *unarmored scale* insects. HETP and TEPP are not promising in citrus thrips control. When used as sprays under certain conditions both are fairly effective on citricola scale, but not effective on cottony cushion scale.

Parathion is highly toxic to citrus thrips, but the residual action apparently is too short to offer sufficient control of this pest in the spring season to prevent fruit scarring; late summer treatments for protection of fall flush of growth were more promising.

Parathion shows considerable promise in control of single-brooded black scale, citricola scale and cottony cushion scale. Against the first two species a marked effect in control has been observed 2 to 4 rows away from the plots treated with sprays and dusts in late summer.

Typical results are: (A) "Thiophos 3422" wettable (parathion 25%) applied at 1 lb. per 100 gals. water was 96% efficient on single-brooded *black-scale*, as compared with the conventional treatment of light medium grade oil 1¾% affording 98% efficiency; (B) "Thiophos 3422" wettable (parathion 25%) applied on Sept. 11, 1947, at dosage of 1 lb. per 100 gals. water, with a pre-treatment count of 24 live *citricola scale* per leaf showed on Oct. 17 a count of no live citricola scale, and 1% parathion dust applied at approximately 1 lb. per tree with a pre-treatment count of 30 also showed no live scale on Oct. 17, both compared with the untreated check plot which showed counts of 17 and 6 respectively; and (C) "Thiophos 3422" wettable (parathion 25%) applied on October 2, 1947, at ½ lb. per 100 gals. water showed on Nov. 20 no live *cottony cushion scale* per 8-inch terminal, and 2% parathion dust applied at approximately 1 lb. per tree showed an average of 0.01

(*Turn to Page* 81)

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The Listening Post

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Survey, Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Md.

By Paul R. Miller

SPECIMENS of gladiolus spikes, Picardy variety, received at the Florida Agricultural Experiment Station from Fort Pierce in August were discovered to have many diseased spots black with spores of a species of *Curvularia*, a fungus not previously reported to be associated with diseases of this plant. Upon visiting the field from which the specimens came, every floret and practically every leaf were found to be spotted with brown to black lesions. The only fungus consistently found on the spots was the *Curvularia*. Similar specimens were received later from other parts of Florida and from a location in Alabama where the disease was said to have caused much damage during the summer. Early in November the disease was observed in all of the chief winter gladiolus production areas of Florida. The *Curvularia* was associated with the diseased spikes, corms, or leaves, and experiments proved it responsible.

Leaves, stems, and florets are attacked, the spots varying in shape and size with the part affected. The spots grow rapidly, e.g., on leaves they are pin-head size at first, a week-old spot may be one-half inch long and a week later it may be 2 inches long. On infected bud sheaths infection penetrates into the petals, often preventing the opening of the florets. The edges of the petals may be discolored, becoming brown or on Picardy florets, lavender.

The greatest losses from *Curvularia* spot have been in the varieties Picardy, Corona, and Vredenburg. Most of the other important commercial varieties appear to be resistant. The leaves of Picardy may be killed to the ground. In some cases where leaf spots were few, infections of Picardy spikes have been severe. Most of the Picardy spikes observed in a few packing houses visited in November were found to be diseased. On one visit, spikes that were free from spots were packed as if for shipping and opened 2 and 3 days later; some of the florets by then were disfigured by *Curvularia* spots. Similar tests showed that the moisture which condensed in the florets of packaged spikes was sufficient to bring about typical spotting of the petals which had been seeded with spores of the fungus.

In fields where leaf spotting was severe, growers appear to have controlled the disease by frequent spray applications of "Dithane" with zinc and lime. After 3 applications of "Dithane" within one week, diseased spikes in one field fell from about 95 to 5 percent in a 10-day period. It may be impractical to control the disease during the summer when temperatures range from 70 to 90° F. and rains are very frequent. However, the disease apparently was controlled this fall in those fields sprayed every 5 days with the following mixture: "Dithane D14," 2 quarts, zinc sulfate (25% Zn) 1 pound, and hydrated lime ½ pound in 100 gallons of water, plus a wetting agent. Two pounds of a wettable DDT were added in most applications.

The results of a preliminary spray test indicated that "Dithane" and "Puratized Agricultural Spray" 2½ pints per 100 gallons were equally effective in preventing infection of the leaves. Infection of the spikes was prevented by a 2-second dip in a solution of "Puratized Agricultural Spray," 1¼ pints in 100 gallons plus 1¼ pints of "Ultrawet 30E." These spikes were inoculated by spraying with a spore suspension of *Curvularia*, and dried off 1½ hours before dipping in the fungicidal solution. After dipping they were wrapped and kept moist in the package for 2 days. Control spikes handled in the same manner but not dipped in the fungicide became severely infected. Some spikes were inoculated 17 hours before dipping; these became infected to a degree somewhat less than the controls.

Rust Control on Calendula

RUST, caused by *Puccinia flaveriae*, appeared very suddenly and spread rapidly on calendula or pot marigold in a cloth house at Texas A. and M. College. The plants were benched in a ground bed and spaced 10 inches each way. When examined on October 28, all the plants appeared healthy. Two days later spots were noticed on the older foliage of 25 plants. By the next day the disease had spread so that 40 plants were diseased.

On this day, November 1, the entire bed was sprayed with "Fermate," 2 pounds per 100 gallons of water, with a new spreader, "PCC," a product of the Planetary Chemical Co., at the rate of 10 fluid ounces to 100 gallons of water. Six gallons of this mixture were applied to the 200 square feet of bed. Only the one application was given.

No new lesions were observed to develop after the spray was applied. Between October 28 and November 11, daily temperature recorded at 8 A. M. ranged from 70 to 55° F. During the following 2 weeks, early morning temperatures were usually below 55° F. but well

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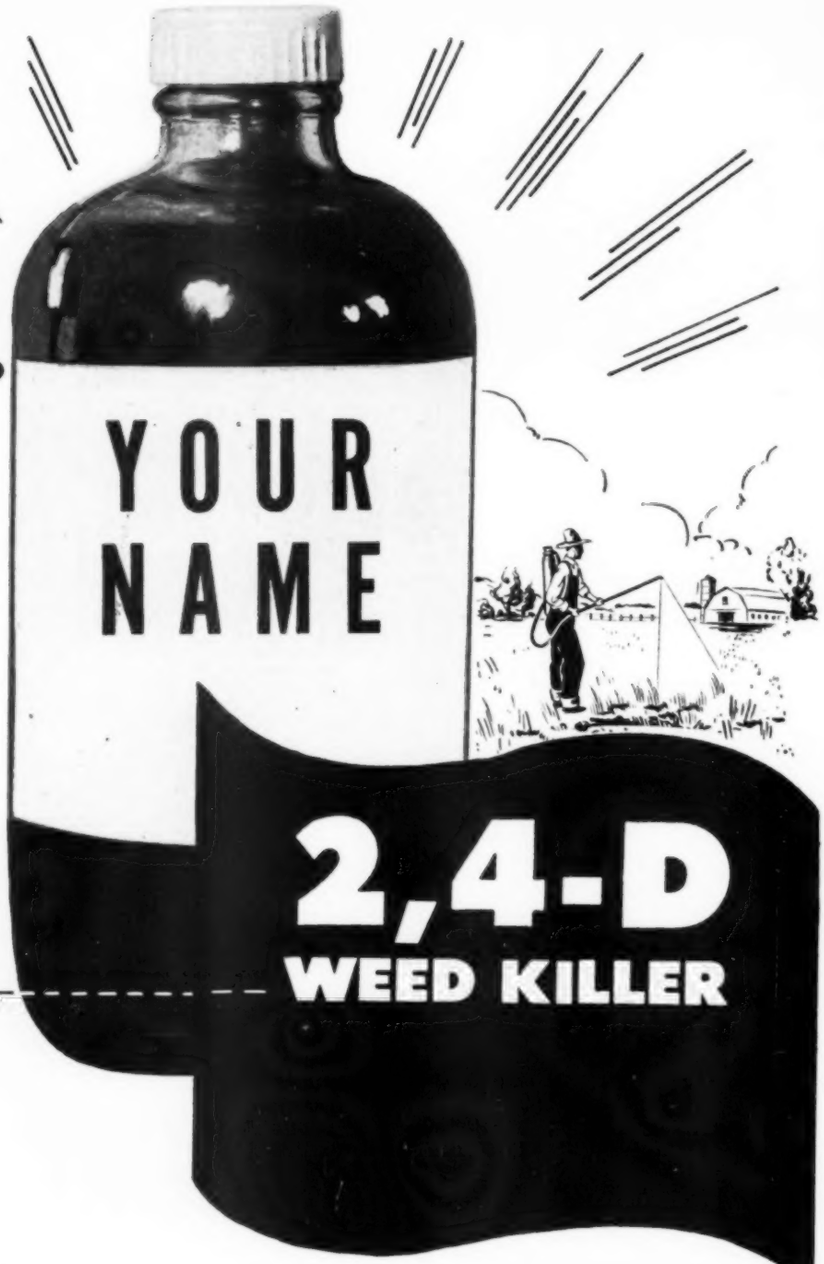

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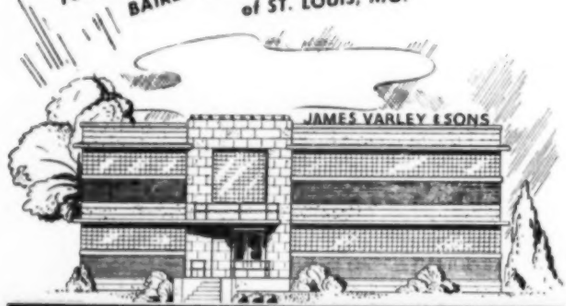

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above freezing. Whether the practically complete control obtained was due entirely to the fungicide or partly or wholly to the drop in temperature and rainy coudy weather that followed its application cannot be decided since it was not possible to keep unsprayed control plants for comparison. "Fermate" was chosen because of its high specificity for apple rusts, and the results of this test suggest that it may be useful to control calendula rust as well.

Leaf Spot & Defoliation

ROSE plants in commercial greenhouses in Raleigh, North Carolina, were severely affected by leaf spot and defoliation in September and October this year. Suggested causes were various diseases and HETP (hexa-ethyl tetraphosphate) injury. However, microscopic examination and greenhouse observations showed that none of the suspected diseases could have been responsible; neither did the use of HETP Aerosol bombs for insect control appear to be a factor. On the other hand, a fungus known as *Mycosphaerella rosigene* was consistently found in every spot of a certain size. These spots in great numbers were constantly associated with yellowing and falling off of affected leaflets and leaves.

The disease was severe in several houses on plants of Briarcliff and Better Times varieties. It was particularly prevalent on large plants in manured beds, on which defoliation as high as 90 percent had occurred. In several other houses containing younger plants with less dense foliage, the disease was present but it was not of sufficient intensity to cause any appreciable defoliation.

Insect Conditions in Late December, Early January

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Haeussler is in charge of Insect Pest Survey and Information, Agric. Research Adm., B. E. & P. Q., U.S.D.A. His observations are based on latest reports from collaborators in the department's country-wide pest surveys.

By G. J. Haeussler

NO insect damage of commercial importance was reported on beans during the last half of December and early January except in Dade County, Florida, where infestations of the bean leaf roller have varied from light to moderate. The pest was being held in check in this section by use of insecticides.

Cabbage caterpillars, especially the imported cabbageworm, were reported infesting cabbage and related crops during late December and early January in parts of South Carolina, Georgia, Florida, Alabama, and the lower Rio Grande Valley of Texas. During the last half of December, cabbage caterpillars caused considerable damage to broccoli and cabbage in the latter area, despite the prevalence of cold, wet weather.

The vegetable weevil was infesting turnips severely during the last half of December in Georgia, Florida and Alabama aand infestations were reported as light to moderate on that crop in South Carolina. Populations were increasing on all crucifers during early January in South Carolina, Georgia and Florida. Spotted and banded cucumber beetles and the southern green stinkbug continued to cause limited injury to most crucifers in Georgia, Florida, and Alabama.

The serpentine leaf miner, which was causing light injury to tomato plantings in Dade County, Florida during the last half of December, increased in abundance on Irish potato in that area in early January, the infestations being spotted and ranging from numerous to serious.

Toward the middle of January, the southern armyworm was destructive on tomato in Martin County, Florida, the fall armyworm was moderately abundant on onions in experimental plots in the Belle Glade district, and cutworms were present in light to moderate numbers on vegetables in the Everglades. Cutworms caused severe damage to new plantings of cabbage and broccoli in the lower Rio Grande Valley of Texas toward the end of December.

The onion thrips occurred in moderate numbers on onions in the Coachella Valley of California toward the middle of January and considerable infestation by this pest occurred on the lower leaves of newly set cabbage plants in Orange County. At that same time the eggplant whitefly and two-spotted mite were numerous on eggplant in the lower Coachella Valley and a heavy infestation of the mite occurred on celery in Orange County.

Aphid infestations on cabbage and related crops were generally light to moderate during the last half of December and early January in South Carolina, Georgia, Florida, Alabama, and southern California. The green peach aphid was reported as continuing to develop on turnip, cabbage, collards, and several wild host plants in northern Florida. Aphids were becoming abundant on celery in some parts of Florida in early January.★★

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To New Plant in Iowa

Barnard & Leas Mfg. Co. has moved its plant to Cedar Rapids, Iowa, from the former location at Moline, Ill. The ninety-year-old firm, makers of milling machinery and packing machines for bags, sacks and barrels is carrying out an expansion program launched three years ago when the company was purchased by the Ronk interests. George T. Ronk, president, indicates that in conjunction with the increased production schedule in the new factory, much of the machinery line has been redesigned and streamlined.

LOOK TO LOWELL for Consistent Insecticide Sales

Ask anyone why he prefers a certain brand of insecticide and he'll likely say, "It does the job." To help your product—liquid or powder—do that job effectively, is the main purpose of the Lowell engineering staff. Don't be "insecticide-wise and sprayer-foolish." Let Lowell Sprayers and Dusters do the job for you!

The Sentry The Premier The Pennant

"When I sell an insecticide customer a Lowell sprayer or duster, I can be sure the insecticide will be applied correctly and repeat sales will follow."

A Lowell Dealer
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WORLD'S LARGEST MANUFACTURER OF SPRAYERS AND DUSTERS EXCLUSIVELY

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Suppliers' Bulletins

2,4-D Book Available

Hobart Publishing Co. has issued a new 68 page book on "Turf Control with 2,4-D," written by Dr. Fannie-Fern Davis, turf consultant of the National Capital Park Service, Dept. of the Interior, Washington. The book describes methods used in the Capital to control weeds in turf. A seasonal sensitivity schedule for more than 50 weeds and detailed description of a one-step treatment which includes application of 2,4-D plus fertilizer and grass seed are given. Price of the book is $3.25, postpaid, from Hobart Publishing Co., Box 4127 Chevy Chase Br., Washington 15, D. C.

•

Offers Varied Booklets

Riverdale Chemical Company, Harvey, Illinois, has issued new folders on the use of its weed killer product, "Weedestroy 43," butyl ester of 2,4-D. The material is designed for use in crops for the control of weeds. The company also announces that bulletins are available describing use of "Rivicol" insecticides, with chlordane bases. Separate bulletins have been published to cover control of ants, roaches, livestock pests, grasshoppers, and truck and garden insects. The firm's address is 324 E. 147th St., Harvey, Ill.

•

Insect Control Report

The Office of Technical Services, Department of Commerce, Washington 25, D. C., has offered for sale a 49 page report on the occurrence, biology and control of insects which destroy grain in storage. The report, prepared by the British Intelligence Objectives Sub-committee, discusses the fumigants, sprays, chemical dusts, inert mineral dusts and other control measures used by the Germans against insects and mites which infest stored grains. Mimeographed copies of the report, #PB 27714, "The Storage of Grain in Germany with Special Reference to the Control of Insect Pests" are available for $1.25. Address the O.T.S., address same as above, and make check payable to Treasurer of the U. S.

•

New Dow Product

Dow Chemical Co., Midland, Michigan, has announced the development of a new dinitro fungicide and insecticide for use in orchards. The material is triethanolamine salt of dinitrosec-butylphenol and is said to be effective against a wide range of fruit insect pests and diseases. The material, now ready for commercial use under the trade name of "DN-289", has been used experimentally since the 1942 season.

•

Cyanate Weedkiller Info

American Cyanamid Co., New York, has prepared a folder "Control of weeds in onions," describing the action of its product, "Aero Cyanate." Information is given regarding the properties of the material, when to apply it, and methods of application. The weedkiller should be used at two different concentrations, depending upon the size or stage of growth of the onions, the booklet says. A table is given as a guide for preparing spray solutions, with warnings regarding excessive use. The folder is available from the firm's agricultural chemicals division, 30 Rockefeller Plaza, New York 20.

•

Screening Results Told

The U. S. Department of Agriculture has recently published a 235 page work containing the results of screening tests with materials evaluated as insecticides, miticides and repellents. The work had been carried on at the Orlando, Florida laboratory from April, 1942 to April, 1947. The materials tested are listed in alphabetical order under the general headings of lousicides, mosquito larvacides, miticides, and mosquito repellents. The items are numbered in order, from #1 to 7,076; the latter being the number of materials screened.

The bulletin was assembled from work conducted under a transfer of funds, recommended by the committee on medical research and development, to the Bureau of Entomology and Plant Quarantine. Beginning Nov. 1, 1945, the work was continued under a transfer of funds from the office of the Surgeon General, U. S. Army.

•

Diatomaceous Earth Guide

Eagle-Picher Company, Cincinnati 1, Ohio, has issued a new booklet explaining diatomaceous earth and its uses in chemical process industries. The material, used as a carrier for fertilizers and insecticides, possesses high absorptive qualities, and is extremely light and porus. The booklet was published as a guide for the use of diatomaceous earth in chemical process industries.

•

Grinder Described

The Bauer Bros. Co., 1793 Sheridan Ave., Springfield, Ill., has recently published a new bulletin describing its attrition mill. This mill, with 3 to 20 hp input, is adaptable for fine or coarse grinding, granulating, shredding or fluffing industrial or agricultural products, the booklet states. A copy is available upon request.

•

Livestock Movie Shown

The premiere showing of "Better Livestock," sound and color film, was announced late in January for Thursday evening, February 5, at the Hoof and Horn Club, Livestock Exchange Building, Kansas City. The movie was produced by the John Bean Division of Food Machinery Corporation, Lansing, Michigan, with the cooperation of the National Livestock Loss Prevention Board, Kansas City office. The film records some of the newer practices of livestock parasite control, and in profitable livestock production.

NOW for safer, better, more economical home garden insecticides

Piperonyl cyclonene

Today, safer, better, more economical home garden insecticides can be readily made—by combining *piperonyl cyclonene* with pyrethrum, or rotenone, or both.

Here's why –

Insecticide formulators know that packaged insecticides for home gardens, small truck farms, and related uses must meet two *special* requirements. They must be effective on a wide variety of insects (in order to be useful on the full range of vegetable crops, flowers, and ornamental shrubbery). They must be *completely safe* under all possible conditions of use or misuse.

To meet these requirements, insecticide formulators in the recent past have had to depend mainly on rotenone, or pyrethrum, or combinations of the two. But *now*, the demonstrated safety of piperonyl cyclonene . . . its proven synergistic behavior with rotenone and pyrethrum . . . add a new effectiveness to home garden insecticides — *and economically, too!*

Since January 1, 1948, the insecticide products of D&O are being marketed by U. S. I.

U.S.I. INDUSTRIAL CHEMICALS, INC.

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Technical Briefs

Elm Disease Control

When treated with 8-quinolinol benzoate, Dutch elm diseased trees suffer half as much as untreated trees. Beneficial effects are most pronounced when 0.1 percent solutions are injected under pressure into the soil around feeding roots at the rate of 5 gal. per inch DBH. Surface watering over feeding roots is less effective and scattering of dry chemical followed by watering is ineffective. Treatment before leaf buds expand is without effect; in May and June treatment results in fewer foliage symptoms than in checks; and in August and September it reduces overwinter dieback. Trees treated in very early stages of infection are benefited most; those treated after involvement has become extensive are scarcely benefited. Although remedial action starts to disappear within 90 days and wears off completely in one year, differences between treated and untreated trees may be maintained by reapplying the chemical within six months to a year. Healthy trees may possibly be protected against natural infection when inoculum potential is low. Recovery of diseased trees is infrequent, but treated ones recover more often than untreated ones do.

—Dimond, Dr. Albert E., *Phytopathology*, Vol. 38, January, 1948.

•

Dairy Plant Detergents

Experiments were conducted to study the requirements for formulating a cleansing agent for specific uses in the dairy industry. The most effective cleansing agent contained sufficient polyphosphates to keep hardness-producing salts in solution, a synthetic wetting agent for ease of contact, and adequate active alkalinity to dissolve denatured protein. Tests for pH, alkalinity, surface tension, and turbidity-preventing power were most informative with regard to the probable performance of a cleansing agent under actual use conditions. Amounts of polyphosphates are given which prevent turbidity at different levels of water hardness. H. C. Harding and H. A. Trebler, *Food Technol.* 1, 478-93 (1947).

•

Sheep Dips

Sodium arsenite dip containing 0.2 per cent of As_2O_3 protected sheep to a large extent from tick reinfestation for 1-2 weeks. Coal-tar creosote dips kill attached ticks but afford no protection from reinfestation. Derris as ground root or extract, kills all attached ticks at 1:15,000; at 1:5,000 its effective period of protection is comparable to arsenite at 0.2 per cent.

Maximum effective duration is apparently 14-17 days. Addition of wool grease to the dip enhances the effective action time of arsenic but not of derris. Immersion time is important for both arsenic and derris dips, but especially for the latter, for which it must be at least a half minute. A protective dip containing arsenic, derris, cresols, and wool grease has been evolved which protects sheep for about 3 weeks. J. MacLeod, *Ann. Applied Biol.* 34, 207-23 (1947).

•

Chromates as Fungicides

Since 1941 numerous compounds containing chromium together with from one to four other metals have been under test, as potato fungicides in Pennsylvania. During 1946 and 1947 certain of the most effective chromates have given outstanding results in the control of both early blight (*Alternaria*) and late blight (*Phytophtora*). When these diseases are serious enough and infection takes place early enough commensurate differences in yield are seen. When used alone, these chromates have been shown to have insect-repellent properties equivalent to Bordeaux mixture and when used with DDT the yields produced have equaled or surpassed the yields obtained from use of "fixed coppers," "Dithane," and Bordeaux.

—Thurston, H. W., Jr., J. G. Leach, and J. O. Wilson, *Phytopathology*, Vol. 38, January, 1948.

•

Fly Control in Dairy Barns

Cooperative spraying services for the control of flies on farms are practical when an adequate number of power sprayers are available. Benzene hexachloride gave more rapid knockdown than DDT as a barn and animal spray, and appeared equally effective in residual action. E. N. Cory and G. S. Langford, *J. Econ. Entomol. 40*, 425-6 (1947).

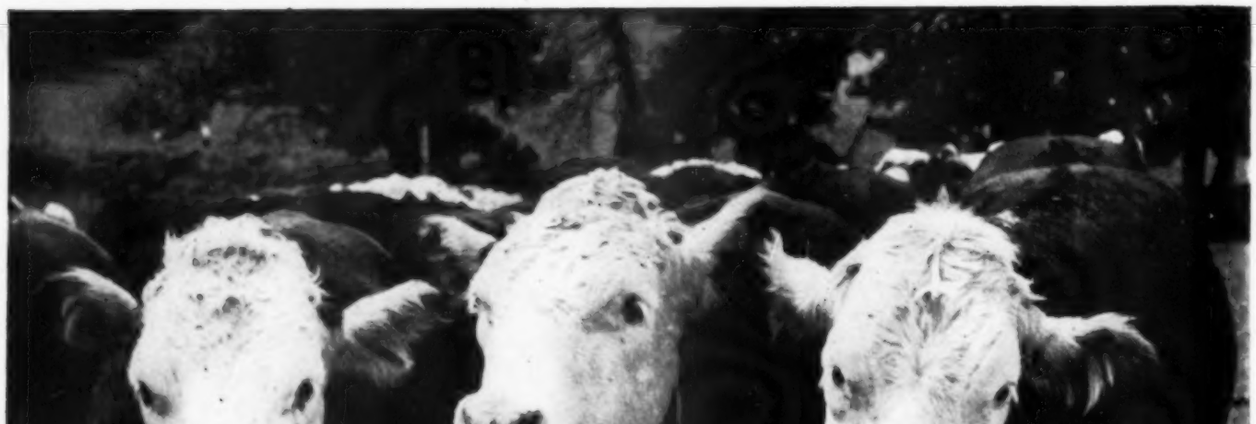
•

Fertilizer Coated Seed

Big yield increases have been obtained at East Malling Research Station, England, by coating cereal seeds with di-and tri-potassium phosphate. Seed is soaked in 5% solutions of K_2HPO_4 or K_3PO_4, then dried at about 22°C. Wheat seed was damaged by solutions stronger than 5% but barley and oat seed tolerated up to 30%. Seed thus treated was sown in phosphate-deficient soil and remarkably good results were obtained. 1.4 lbs. of P_2O_5 soaked and dried on the seed (wheat) gave an extra yield of 1.1 cwts. per acre; on similar soil 64 lbs. of P_2O_5 applied as basic slag in the usual manner gave a yield increase of 1.5 cwts. per acre. In another comparison, 1.4 lbs. of P_2O_5 used in seed soaking gave an extra yield of 0.75 cwts. per acre but 48 lbs. of P_2O_5 as slag gave only 0.4 cwts. increase. It is obvious that the P_2O_5 applied in this new method is many times more efficient than P_2O_5 applied to the soil.

With oats, the application of 4.6 lbs. of P_2O_5 per acre as seed-soaked K_3PO_4 gave increases from 17 cwts. to 25 cwts. per acre, and approximately 75% of the P_2O_5 added was recovered in the crop. A similarly large increase in straw yield was given.

—*Soils and Fertilizers* X. 2 1947. pp. 121-122.



LIVESTOCK

To help you meet AN EVER-GROWING MARKET—

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CROPS

FORESTS

PUBLIC PLACES

Use of DDT spreads every year. More and more people depend on DDT for controlling certain insect pests of livestock, crops, gardens, homes, orchards, forests, and public places.

Farmers find spraying cattle with DDT during fly season often increases beef gains as much as ½ to 1 pound per day . . . increases milk production as much as 20 per cent. Spraying potatoes increases yields up to 25 per cent, sometimes more.

Public officials and owners of recreational facilities spray parks, ball fields, grandstands, resorts, and other public places with DDT—to help promote public health, as well as make the facilities more enjoyable.

Foresters recently sprayed 387,000 acres of forest land in the Northwest with DDT to save an estimated $60,000,000 worth of timber from Douglas fir tussock moths. In the Northeast forests DDT is being used to control the gypsy moth.

Increased use of DDT means an expanding market to those who formulate insecticides. Get set now for next year's sales.

Baker's DDT is a granular product approaching a white color, with a minimum setting point of 89° C. It is uniform in color, makes a clear solution, is free flowing and uniform in particle size. This enables the manufacturer to perfect his mix before grinding.

Baker's DDT comes in 25, 50, 100 and 200-lb. containers. We invite you to write for prices and tell us your requirements. Address *Agricultural Chemical Division,* J. T. Baker Chemical Co., Phillipsburg, N. J.

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Fertilizer & Grass Quality

It is well enough known that complete fertilizer treatments must be regularly given for the production of high grass yields with maximum protein content, but some long-term tests in Yorkshire, England, have shown that a good sward rapidly deteriorates in botanical composition if fertilizers are withheld. Re-seeded grass with an initial fertilizer treatment cropped 13.07 tons per acre and botanical analysis showed that the sward contained 83% 'good' grasses and 17% clovers. Two years later, with no further fertilizer treatment, the yield had dropped to 11.62 tons per acre, but the 'good' grass percentage was 50%, clovers 30% and weeds 20%. After two more years without treatment the yield was down to 10.04 tons, the 'good' grasses were present only to a 25% extent, clovers were up to 33%, and weeds had risen to 42%. The botanical deterioration of the sward was clearly more serious than the fall in the annual yield. It is uneconomic to re-seed for better grass crop or better pasture if this is not followed up with regular and balanced fertilizer treatment; initial fertilizer dressings are not enough.
—H. I. Moore, *Farming* I. 10 pp. 293-300.

•

Nitrogen & Apple Growth

Investigations were conducted through 4 years to determine the relation of season of nitrogen application to response in mature apple trees. Under the conditions of these experiments the following conclusions are indicated:

On relatively old York Imperial and Delicious apple trees fruit set, color, and yield were not influenced by season of nitrogen application. Greater downward leaching of nitrate occurred when sodium nitrate was applied to the soil in early or late fall than when applied in spring or midsummer. With mature trees this greater leaching into the second and the third foot of soil apparently was not reflected in less nitrogen intake and tree growth.

Nitrogen content of blossoms, shoots, leaves, bark, wood, and roots, which was determined throughout these experiments, did not indicate any large or consistent difference due to time of nitrogen application. After 4 years of treatment of mature apple trees no difference was found between fall and spring applications in the nitrogen reserve contained in the various tissues of the tree. Results with mature apple trees strongly suggest that, if the level of nitrogen metabolism is satisfactorily maintained within the tree, it makes little difference at what season of the year the soil supply is replenished.

Tests were conducted during 5 years with young Starking Delicious, Rome Beauty, and York Imperial trees. Late-spring and midsummer applications of nitrate nitrogen resulted in a higher nitrogen level in the foliage, which in turn was associated with greater growth and in Rome Beauty with less fruit color.
—*J. Agricutural Research,* Vol. 76, No. 1.

Please

When writing to AGRICULTURAL CHEMICALS, address all correspondence to our New York address, 254 West 31 St., New York 1. Circulation, advertising and editorial offices are all at this address. The magazine is produced and mailed in Baltimore, but all mail sent there must subsequently be forwarded to New York. The words "Publication Office" on our masthead is a phrase required by the Post Office Department.

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Chinch Bug Study

In an effort to find chemical differences among sorghum varieties which might help account for differential resistance to chinch bug injury and thereby expedite a breeding program, considerable heretofore unavailable data on varietal differences in chemical composition and changes occurring during growth was obtained. No positive relationship was found between chemical composition and resistance. However, on the basis of data from these experiments it appears that some of the existing theories do not adequately explain known differences in resistance. Factors apparently having no important relationship to resistance include tannins, hydrocyanic acid, total sugars, and total acidity. It is doubtful if the relation between reducing sugars and sucrose has any significance. Bleeding does not seem to be an important factor. The data obtained will be useful to those interested in the use of sorghums for feeding and industrial purposes; they give a continuous picture of the changes that occur in plants and expressed juice from the time the plants start to grow until heading begins. Chemical analyses reported include solids, ash, certain mineral elements, sugars, nitrogen, tannins, hydrocyanic acid, and certain enzymes for several sorghum varieties over a period of years.
—*What's New in Oklahoma Agriculture, January,* 1948.

•

Curculio Beetle Control

BHC plots of plums contained less wormy fruits than lead arsenate plot, even at a dosage of 1 pound (0.06 pound of gamma isomer) per 100 gallons of water, but few beetles were killed by the applications. A minimum of 6 percent gamma isomer was necessary for good kill of adult beetles. At a 4 pound dosage, the residue on foliage and fruit killed beetles for approximately 5 days.

Preliminary field tests indicated that chlordane was effective in killing adult curculio beetles when used at the rate of 1 lb. per 100 gallons of water. TEPP gave promising results in the field at 1 pint per 100 gallons. HETP did not give satisfactory kill of beetles in the field at the same rate. BHC, chlordane, TEPP and HETP readily killed *Macrocentrus ancylivorus* Roh., at the contrations used, but the latter two materials are not important since they are contact insecticides. — M. L. Bobb, *Virginia Fruit,* 36 (1), January, 1948.

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1. Grain conservation, in farm and commercial storage, and in freight cars, trucks and ships, through control of rats, insects and fungi.

2. Increased meat and milk production through control of animal parasites.

3. Increased cotton and cottonseed production by better pest control.

4. Greater 1948 corn production by controlling pests, particularly the corn borer.

5. Greater production of corn, wheat and other small grains by controlling weed pests with herbicides.

6. A pantry pest-control program to conserve household foodstuffs.

7. Full support of the Freedom Gardens program.

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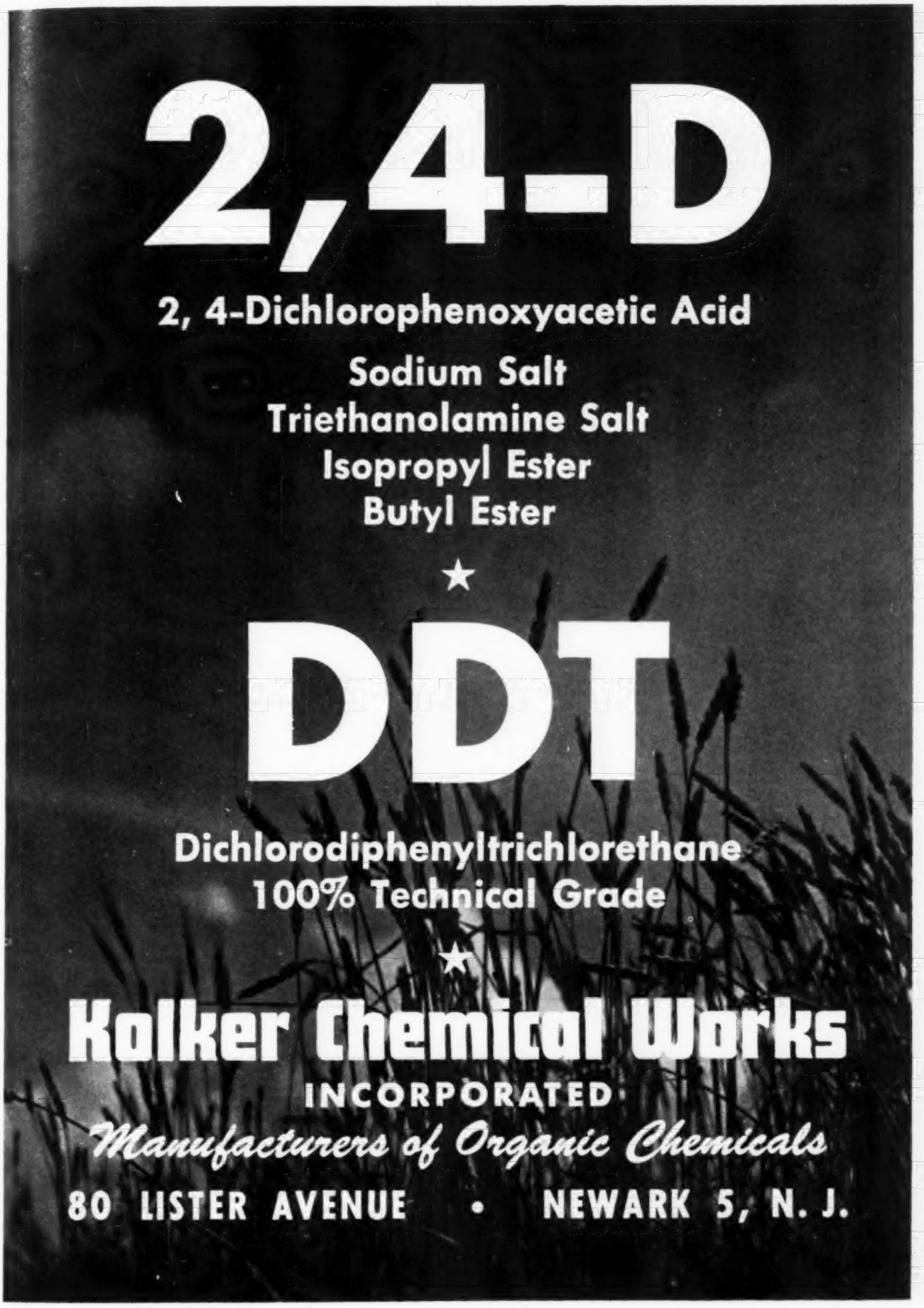
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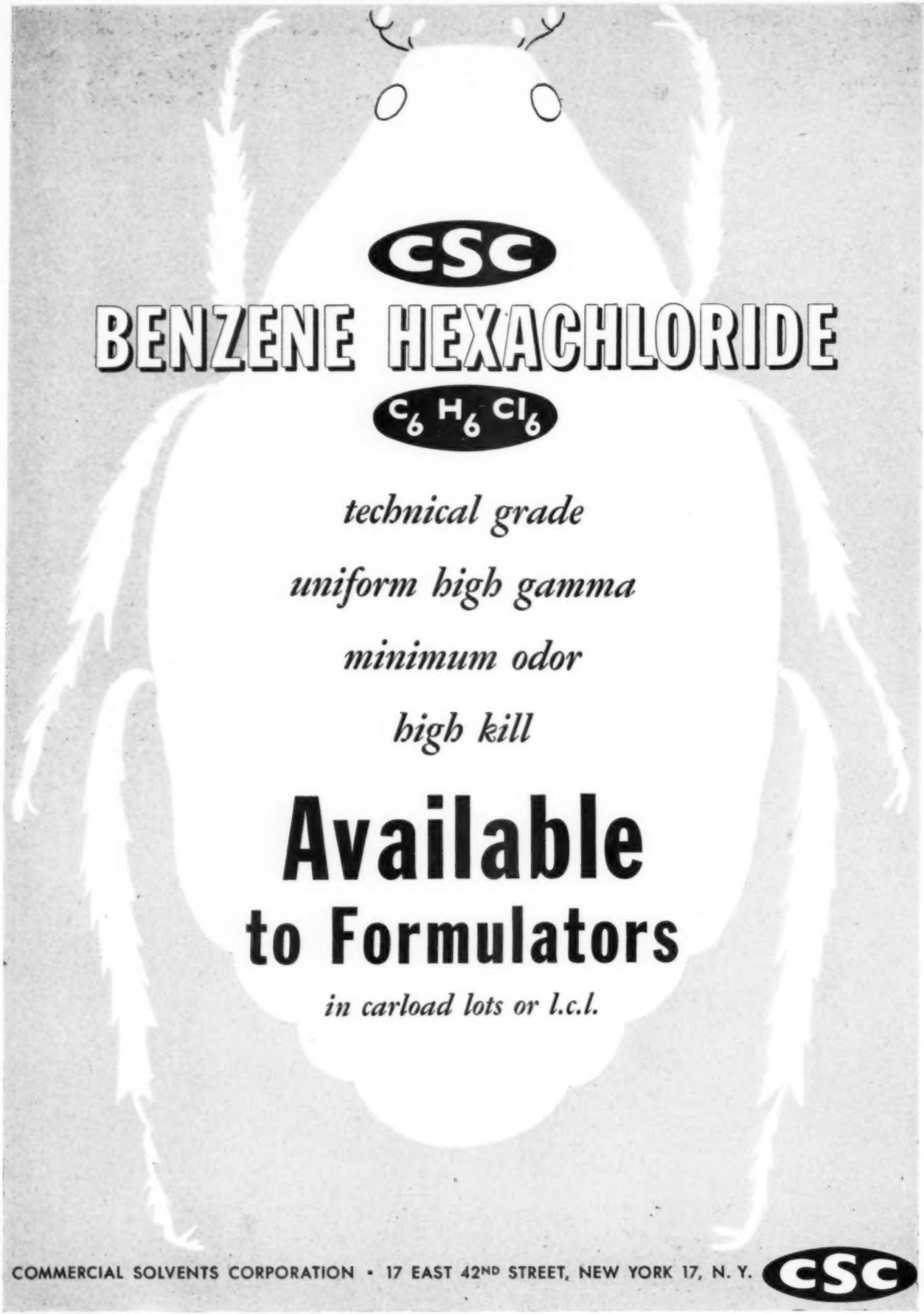
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INDUSTRY NEWS

To Start New Company

William J. Haude, vice-president and sales manager of John Powell & Co., New York, and Dr. J. B. Skaptason, technical sales director, have announced their resignations. They will be associated in the operations of a new company, marketing a line of insecticides and agricultural chemical products to be made by a basic coal tar manufacturer associated with a large Pittsburgh steel producer. Full details of the new company's organization will appear in our next issue.

Mr. Haude had been associated with John Powell & Co. for the past twelve years and Dr. Skaptason for the past three years.

•

New Pennsalt Plant

Pennsylvania Salt Manufacturing Co., Philadelphia, has announced plans to build a new fluorine chemicals plant near Paducah, Kentucky. The new plant is expected to provide additional facilities to the firm's expanding production of fluorine chemical products. Actual construction will start soon, and the first unit is expected to be completed in a year.

Plans for the new plant include single and multi-story buildings on a site directly north of Calvert City, between Paducah and the new T.V.A. Kentucky dam at Gilbertville, from which electrical power will be received. Approximately ten acres of a 500 acre tract purchased by the firm will be occupied by the plant.

In charge of the new operation will be James McWhirter, formerly superintendent of the company's plant at Natrona, Pa. Mr. McWhirter was recently placed in charge of Fluorine Product Process development and manufacture for the company. He will supervise construction of the plant, and plans to make his home in the Paducah area. Completion of the new plant will bring to a total of eight the number of

JAMES MC WHIRTER

Pennsalt plants. Present plants are at Natrona, Easton, and Cornwells Heights, Pa.; Wyandotte, Mich.; Tacoma, Wash.; Portland, Ore.; and Bryan, Texas.

•

DCAT Dinner, Mar. 11

Over 2,200 representatives of the chemical, drug, soap, paint, ink, and allied industries will attend the 22nd annual dinner of the Drug, Chemical and Allied Trades Section, N. Y. Board of Trade, at the Waldorf Astoria, New York, March 11.

Meetings

South Dakota State Weed Conference, March 17 & 18, Brookings, S D.

North Central States Branch, A.A.E.E., Hotel Pere Marquette, Peoria, Ill., March 25 and 26.

National Fertilizer Association, Annual Summer Meeting, June 21, 22, 23, White Sulphur Springs, Va.

Eighth International Congress of Entomology, August 9-15, Stockholm, Sweden.

DDT Prices Reduced

Prices of DDT were taking a severe drop as this issue went to press. During a ten day period during the latter part of January and early February, quotations went down 8½¢. Technical grade DDT in carload lots fell from 37½¢ to 31¢ in a single reduction, and later slipped another two cents. Although there is ordinarily a two cent differential between the technical grade and the lump variety, this difference was eliminated when the price of technical plummeted to its new low. It was expected in some quarters, that some sources would quote a price for lump DDT at two cents under the low price for technical DDT.

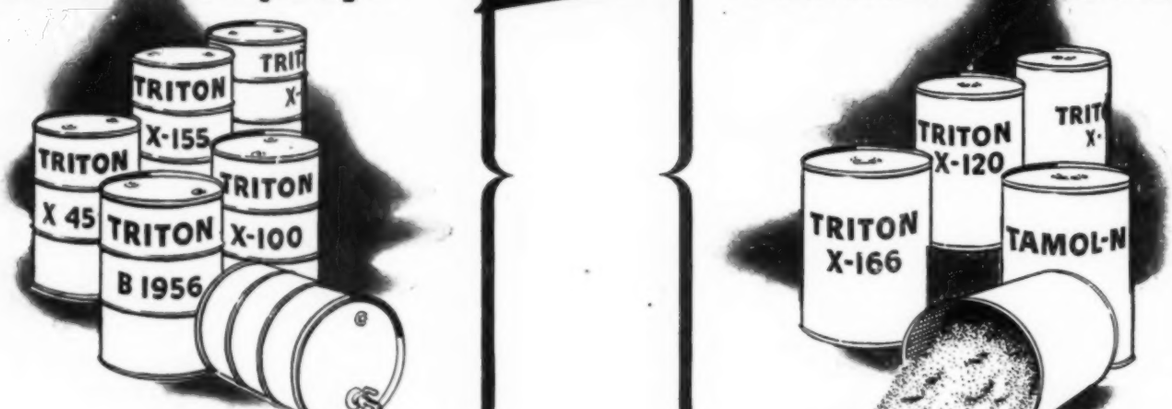
In keeping with lower prices for technical DDT, the prices for DDT formulations were also reduced to the trade by some manufacturers. At press time, three leading manufacturers of such formulations in branded packages of various types and sizes were quoting as follows: DDT 50% wettable powders, in 50 lb. bags, carloads and less carloads, 27¼¢ and 28¼¢ lb. less 10% to supply houses and distributors; in cartons containing various smaller packages in bags, 29¼¢ up to 32¢ lb. or more according to product and makers. DDT 50% dry powders, in 50 lb. bags in carloads and less carloads, 26¼¢ and 27¼¢ lb. less the usual 10% to the trade; in cartons, containing small bags of various sizes, 28¼¢ up to 32¢ lb. or more according to brand.

At the same time, prices on rotenone were showing a downward trend, although many industry leaders expected this trend to halt before further reductions were made. The usual price is 45¢, but was cut to 40¢ in carload lots, and 42½¢ in less than carload. A few sources were reported to have quoted 39¢ a pound.

For more dependable insecticide sprays

OR

For more efficient insecticide powders



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Insecticides and fungicides containing these time-tried emulsifying, wetting and spreading agents have proved themselves superior. TRITON X-100 is included by many U. S. Government agencies in specifications for emulsion concentrates. Whether your formulation is a liquid or a powder, you will find a TRITON to fit your needs. Our research facilities offer fullest cooperation in new developments or data gathered from the widespread use of the TRITONS.

Tritons for use in insecticides and fungicides

FOR LIQUID PRODUCTS

TRITON X-100: High in preference as emulsifier in DDT mosquito larvicides, agricultural sprays and other emulsion type products. Recognized for stability and wetting properties—inexpensive to use. Ideal for formulations of hexaethyl tetraphosphate.

TRITON X-155: Especially developed for use in DDT solvent solutions. An economical emulsifier yet dependable in use with all types of water.

TRITON X-45: An emulsifier for use in oil type agricultural sprays. It is more soluble in oil and less soluble in water than TRITON X-100.

TRITON B-1956: Widely used spreader, depositing agent and emulsifier for oil-base mosquito larvicides, dormant sprays and other oil sprays for fruits and vegetables.

FOR POWDER PRODUCTS

TRITON X-120: A carefully developed wetting agent, especially designed for the powder-type products such as DDT wettable powders. Products containing TRITON X-120 are free-flowing, easily wet and readily suspendable.

TRITON X-166: A wetting, conditioning and dispersing agent for use in the manufacture of dry insecticides and fungicides such as wettable sulfur.

TAMOL N: A conditioner and dispersing agent for use with TRITON wetting agents to furnish ultra-smooth wettable powder products with outstanding suspendability. TAMOL N in conjunction with TRITON X-120 is used in the most efficient DDT wettable powders.

Other TRITONS, *not listed here, are used in a wide variety of industrial and household applications.*

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N. Y. Conference Hears Reports on CHEMICAL CONTROL of Weeds

REPORTS of late developments in chemical control of weeds were scheduled to be given at the Northeastern Weed Control Conference, held at the Hotel Commodore, New York, February 12 and 13. Papers by foremost authorities in the weed control field were listed on the program, including Drs. L. W. Kephart and John W. Mitchell both of U.S.D.A. Bur. Plant Industry Station, Beltsville, Md. who were to speak on "New Weed Control Developments in the U. S." and "2,4-D, Its Physiological Effects on Plants and Factors Affecting its Inactivation in Soil," respectively. Also named on the advance program as guest speaker at the Feb. 12 luncheon, was Hon. Willard H. Allen, New Jersey Secretary of Agriculture.

The meeting was to cover four divisions of weed control: vegetables and potatoes; field crops, pastures and turf; fruit, nursery and ornamentals; and public health and welfare. In addition, a talk on machinery for applying herbicides was scheduled, by Prof. O. C. French, Cornell University; and a discourse on regulatory developments in the marketing of herbicides, by E. A. Walker, U.S.D.A. Fungicide and Herbicide Section, Production and Marketing Administration, Washington.

In a paper prepared for presentation at the meeting, D. M. Parmelee, Seabrook Farms Co., Bridgeton, N. J., told of experiments at Seabrook on beets, spinach and carrots. These weed control experiments were of practical, rather than academic nature, with emphasis laid upon materials which did the best job at the least cost. In summarizing the 1947 weed control experiments, Mr. Parmelee noted that at least three herbicides tested are considered ready for limited commercial application: calcium cyanamid, Stoddard solvents, and Standard Oil "HB."

For selective weeding of asparagus and possibly peas, calcium cyanamid will probably be used, Mr. Parmellee said. Although this product may not be as effective as 2,4-D for asparagus, it can be applied safely by airplane, and is therefore regarded as less expensive. An added advantage of cyanamid, apart from is weed control properties, is its value as a nitrogenous fertilizer which offsets somewhat its cost as a weed killer.

For pre-emergence work, both Stoddard Solvents and "HB" emulsions will be used. Although "HB" has been found to be cheaper and more potent, its residual effect occasionally limits its use, and the other material may have to be substituted. As a selective spray for carrots use of Stoddard solvents is a well established practice, Mr. Parmelee stated, and no change is anticipated.

DR. BENJAMIN WOLF
Seabrook Farms, Bridgeton, New Jersey

In a preliminary paper prepared for presentation at the meeting, Dr. W. A. Hedlin, Cornell University, discussed chemical weed control in onions. His experiments indicate that cyanamid should not be applied on onions at more than 60-70 pounds per acre as a pre- or post-emergence treatment. The lower limit may be less than 60 pounds. If it is to be used to kill weeds after they are up, the foliage must be wet at the time of application. Dr. Hedlin's studies indicate that KOCN* can be used as a selective weedicide in onions if low concentrations are used while the onions are small and applications made before the weeds have grown too large. The foliage must be dry for this material to be effective when applied as a spray.

R. D. Sweet and J. R. Havis, both of Cornell University, prepared a paper on pre-and post-emergence chemical weeding of several vegetables. The herbicidal value of five petroleum products, two growth regulators, and a di-nitro were studied. "Pre-emergence" sprays were applied on the direct-seeded crops: radish, beets and spinach; and "post-setting" sprays on the transplanted crops; tomatoes, cabbage and broccoli. When weeds had already germinated, excellent control was obtained with several petroleums having a boiling range below 650° F., but not with heavier fractions. Applications made immediately after planting were more toxic to the vegetables than were those made just prior to crop emergence. The reason for this unexpected behavior is not clear. It may be that rains on the early treatments brought the toxicants into contact with the seed, or perhaps the wet soils present at the time of the later treatments resulted in dilution of the emulsions.

CLARENCE S. HARRIS
Sr. Agricultural Technologist
Shell Petroleum Corp., N. Y.

The post-setting treatments show the possibilities of eliminating

(*Turn to Page 74*)

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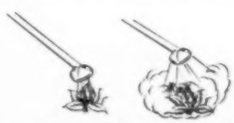

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Fertilizer Plants Built

Six new fertilizer manufacturing plants were constructed by farmer cooperatives during 1947, it was reported in a review of co-op accomplishments by a Farm Credit Administration executive, Harold Hedges. Despite inability to get equipment and the high cost of construction, the six were either totally or partially erected by the following at the points specified:

Delta Fertilizer Co., Helena, Ark.; Northwest Cooperative Mills, Winona, Minn.; Missouri Farmers Association, Springfield, Mo.; Consumers Cooperative Association, Eagle Grove, La.; Wisconsin Cooperative Farm Supply Co., Green Bay, Wis.; Farm Bureau Services, Inc., Saginaw, Mich.

Since fertilizer and building materials are still scarce, several other cooperatives are holding up plans for construction of plants to supply members with fertilizer material, Hedges stated.

•

Purchases Phosphate Land

Central Farmers Fertilizer Co., recently organized by 15 cooperatives located in 12 corn belt states, has announced the purchase from Stockholders' Syndicate, a California corporation, of 2,000 acres of phosphate land in southeastern Idaho. Deposits are to be worked for use in the fertilizer manufacturing and distribution services of the 15 member co-ops backing the venture.

•

Potomac APS Div. Meets

The Potomac Division of the American Phytopathological Society was scheduled to hold its fifth annual meeting February 11 and 12 at the Plant Industry Station Beltsville, Md. The second day's meeting was to be held jointly with the Southern Division at Beltsville, the Southern Division having planned to meet at the Willard Hotel, Washington, on February 13 and 14.

Invited to present papers at the Potomac branch meeting were members of the division and others who wished to report research in the phytopathological field. Division officers are V. F. Tapke, president; W. F. Jeffers, vice-president; W. W. Diehl, secretary-treasurer. The program committee consists of H. Rex Thomas, chairman; Annie R. Gravatt; and John E. Kotila.

•

Collins to Mich. Chem.

Michigan Chemical Corp., St. Louis, Michigan, has announced the

J. G. COLLINS

recent appointment of J. G. Collins as assistant general sales manager. Mr. Collins was for thirteen years with the U. S. Rubber Company in various technical and sales capacities, and since 1942, was sales manager of the agricultural chemicals division. Recently, he was vice-president and general sales manager of Amecco Chemicals, which position he resigned to accept his new connection. He is a graduate of Massachusetts Institute of Technology.

•

New Hanson Sprayer Unit

Howard Hanson and Company, Beloit, Wisconsin, have marketed a new all-purpose sprayer which they report is enjoying brisk sales for control of weeds, insects, and livestock parasites. The sprayer features a combination of centrifugal impeller. with a jet-type venturi which results in a pump described as practically trouble-free even under difficult operating conditions. Powered by a 1½ hp gas motor, the remainder of the unit includes a tank, and booms up to 30 feet in length, adjustable and made to fit all types of equipment.

United Considers Plant

United Cooperatives, Inc., Alliance, O., is studying a proposal for establishment and operation of facilities for processing and compounding agricultural chemicals, including insecticides, fungicides and weed killers. If considered advisable, steps will be taken to provide the plant where these commodities can be manufactured to member specifications, the announcement indicated. Intensive study is to be made of weed killers and a program of quality and safe distribution worked out, R. W. Mills, of the co-op's farm chemical department stated.

•

Form New APS Division

Formation of the Upper Mississippi Valley Group of Plant Pathologists was accomplished at the December meeting of the American Phytopathological Society in Chicago. The new group will be a division of the parent society, the APS. Until a formal election which is to be held sometime in the summer of 1948 at the University of Minnesota, Dr. C. M. Tucker of the University of Missouri will act as chairman.

A committee composed of Drs. R. W. Samson, Purdue University, and H. F. Winter, Ohio State in addition to Dr. Tucker, was instructed to frame a constitution to be presented at the next meeting.

•

Midwest Tree Conference

The third annual meeting of the Midwestern Chapter of the National Shade Tree Conference was scheduled to be held at the LaSalle Hotel, Chicago, February 19 and 20.

Early announcements of the program included a talk by Dr. E. R. Spencer, plant pathologist, Lebanon, Ill., on "Sulfur Dioxide Injury to Vegetation;" by J. E. McDonell, Sherwin-Williams Co., Milwaukee, Wisconsin; and "Recent Advancement in Insecticides," by Dr. George C. Decker, Illinois Natural History Survey, Urbana. Other topics on the advance program included such subjects as drainage, mosquito control, municipal nurseries, and trees in park developments.

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To Washington Position

Irving C. Smith, formerly manager-director of Laucks, Ltd., Vancouver, Canada, and vice-president and director of Monsanto, Canada, Ltd., has been named assistant general manager of Western division of Monsanto Chemical Company, at Seattle, Washington.

•

Heads C. S. C. Division

Commercial Solvents Corporation, New York, has announced the reorganization of the sales department's agricultural division to coordinate the sale of all products entering the agricultural field. Manager of the enlarged division is Daniel B. Curll, Jr., formerly manager of the firm's Dixie Chemical Division. Others on the staff are Dr. Hugh R. Stiles, technical director, and Dr. James G. Sanders, entomologist.

During the past year the company has expanded into the fertilizer and insecticide business to supplement the poultry and livestock feed business in which it had engaged for many years. In 1946 the company purchased the Dixie Ordnance Works at Sterlington, La. where the firm had produced anhydrous ammonia for the Government during the war. Selling activities of this unit were handled by the Dixie Chemical Division, now taken over by the new agricultural division.

DANIEL B. CURLL, JR.
Heads new CSC Agricultural Div.

The most recent development of the company in the agricultural field, however, was the construction of a new plant at Terre Haute, Indiana last year, for the production of benzene hexachloride.

•

Pacific Operators Meet

The eighth annual Pacific Coast Pest Control Operators' Conference was scheduled to be held at the University of California, Berkeley, February 9, 10, and 11. The tentative program, issued in advance of the meeting dates included discussions on rodent control, a study of toxicants used in pest control, and a number of papers on similar topics dealing with household and agricultural pests. Speakers named on the program included Prof. E. O. Essig, W. B. Hermes, Edward S. Dodgers, Wm. H. Hoskins, Emanuel Fritz, A. E. Michelbacher, James R. Douglas, and C. P. Furman, all of the U. of C.

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2. **Will the concentrate be safe on plants, on animals?**
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3. **Will an emulsifier help kill more bugs?**
   Atlas insecticide emulsifiers are *active*. They make sprays go farther, wet better, penetrate better. The kill of some hard-to-kill insects has been multiplied as much as 12 times by proper use of Atlas emulsifiers.

4. **What about hard water?**
   Since Atlas emulsifiers are non-ionic, they make concentrates which are emulsifiable in all types of water.

5. **What about deterioration in cans?**
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Westvaco Names Two

Westvaco Chlorine Products Corp., New York, has announced the appointments of James G. Miller and

J. G. MILLER J. B. PERRY

Joseph B. Perry as resident manager of the firm's new phosphorus plant at Pocatello, Idaho; and mines development manager, respectively. Both men have been with Westvaco for a number of years.

Mr. Miller has had extensive engineering experience in non-metallic mineral production before joining Westvaco 18 years ago. He has subsequently served at company plants at South Charleston, S. C., and Carteret, N. J.

Mr. Perry, a company employee since 1920, was formerly mines manager in charge of Westvaco's magnesite, barite, dolomite and other non-metallic mineral production. His new position, mines development manager, was effective the first of the year.

•

Iowa Weed Meeting

The first annual Iowa State weed control meeting was held in Des Moines coliseum on January 15 and 16. The gathering was a consolidation of 9 smaller district weed control meetings formerly held, and attracted an attendance of 1,800 persons. Commercial exhibitors featured weed and insect control chemicals and disinfectants as well as all types of spraying equipment, including airplane application.

Although originally intended to feature only weed control, the meeting actually took in plant disease control, the enforcement and interpretation of weed laws; insect control, seed testing, and building disinfection. More than 375 custom sprayer operators were included among those registered.

Speakers included Dr. E. P. Sylwester of Iowa State College, Ames; Iowa Secretary of Agriculture H. D. Linn; Dean H. H. Kildee, department of agriculture, Iowa State College; H. T. Hall, supervisor of vocational agriculture for Iowa; Assistant State Secretary of Agriculture, Claude Spry; Prof. H. D. Hughes, I. S. C. Agronomy dept.; Dr. Harold Gunderson, I. S. C. Extension Entomologist; Dr. K. W. Stouder, extension veterinarian; Dr. George L. McNew, head of I. S. C. department of botany; I. Levin, Iowa State Chemist; Dr. A. L. Bakke, I. S. C. research professor of botany; Prof. E. L. Barger, agricultural engineering department, I. S. C.; and Charles Laverty, custom sprayer, Indianola, Iowa.

In addition to the talks on all

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phases of weed and other pest control methods, three movies on the subject were presented. These were shown by representatives of Sherwin-Williams Co., Dow Chemical Co., and Ralston-Purina Co. The meeting, termed as very successful, is expected to become an annual feature to embody all phases of pest control.

•

N. J. Annual Report

New Jersey Agricultural Experiment Station, New Brunswick, N. J., has recently published its 67th annual report for 1945-46, in a book titled "Science and the Land." In its chapter on "Insects," the station links the use of 2,4-D with its mosquito control program, stating that the weed-killer may be very useful. "Vegetation has always been a hindrance in mosquito control operations," it says. "On many salt marshes, tall foxtail grass makes it difficult to maintain ditches and to spray oil on breeding areas. Another troublesome plant is salt marsh elder. Both of these plants have been severely damaged with sprays of 2,4-D.

"In upland areas, 2,4-D is also useful in some places. Experiments show it is ineffective, however, against grass, cattails, and most of the other weeds that give the most trouble in upland areas. Other weed killers may soon be available which will kill these plants where they are undesirable."

Other portions of the book include chapters on animals, plants, soil conservation, insect and plant disease control, engineering, and economics.

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TREX 45 for Toxaphene dissolves as high as 50% of Toxaphene, and following water dilution gives stable emulsions ready for immediate field use. Also provides excellent emulsions with solvent solutions of Toxaphene.

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With the Camera at the AAEE and APS Meetings

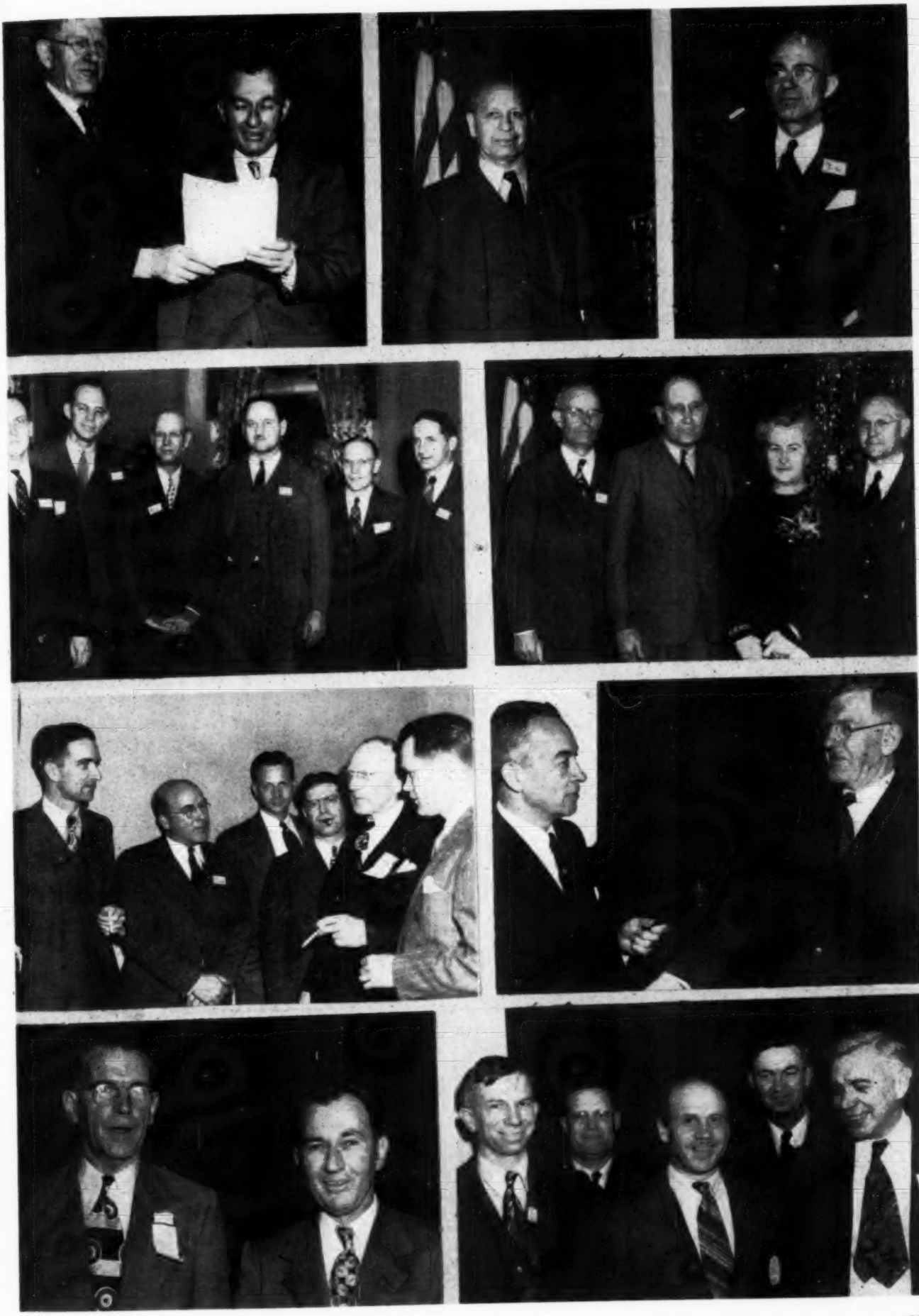
Top row, left to right: (First Photo) S. A. Rohwer, Ass't. Chief, Bur. Entomology and Plant Quarantine, U.S.D.A.; and Dr. A. M. Boyce, Citrus Experiment Station, Riverside, Calif., new president and vice-president, respectively, of A.A.E.E. Second Photo: Dr. E. C. Stakman, St. Paul, Minn., president-elect of the American Association for the Advancement of Science; and third, Dr. A. J. Riker, U. of Wisconsin, outgoing president of the A.P.S.

Second row: Dr. W. H. Bragonier, Iowa State College, Ames; P. J. Leyendecker, Los Cruses, N. Mexico; Dr. C. M. Tucker, Columbia, Mo.; Dr. Geo. L. McNew, Iowa State; Dr. W. J. Hooker, Iowa State; and Dr. A. E. Dimond, New Haven, Conn. (Second photo) A.P.S. Officers: Dr. W. D. Valleau, vice-president, Lexington, Kentucky; Dr. R. S. Kirby, president, State College, Pa.; Dr. Helen Hart, editor, *Phytopathology*, St. Paul, Minn.; and Dr. M. C. Richards, treasurer, Dudham, New Hampshire. (Dr. Curtis May, Plant Industry Station, Beltsville, Md., A.P.S. secretary, was absent when photo was taken.)

Third row: (First photo) T. Walter Reed, California Spray Chemical Corp., Richmond, Calif.; Dr. Stephen S. Easter, Food and Agriculture Organization, U.N.; Dr. C. C. Compton, Julius Hyman Co., Denver, Colo.; Dr. E. W. Laake, U.S.D.A., Kerrville, Texas; and Dr. J. M. Merritt, Tobacco By-Products & Chemical Corp., Louisville, Ky.

Second photo: Dr. Ernest N. Cory, College Park, Md., retiring A.A.E.E. president presents gavel to S. A. Rohwer, his successor.

Bottom row, first photo: Dr. George C. Decker, Urbana, Ill. and Dr. A. M. Boyce. Second photo: Dr. James G. Horsfall, New Haven, Conn.; Dr. J. D. Wilson, Wooster, Ohio; Dr. R. W. Samson, Purdue University, Lafayette, Ind.; Dr. Carl J. Eide, Univ. of Minnesota; and Dr. C. C. Allison, Ohio State Univ., Columbus.



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3. BLACK LEAF DRY CONCENTRATE — used as a spray or dust — a dry powdered nicotine compound for easy mixing and handling.

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Western Co-op Conference Gives

SPRAY SUGGESTIONS for 1948

SUGGESTION for use of sprays for orchard insects and plant diseases in 1948 were made at the Western Cooperative Spray Project Conference held at Portland, Oregon, January 21, 22 and 23. The 1948 suggestions were strikingly similar to those given for 1947,* with some additions and a few changes in recommendations.

Since last year's conference, the use of parathion has come into prominence, and the following suggestions were made for its application. The insecticide has proved effective in control of orchard mites, and the Conference reports that although the material is highly toxic to man and animals, where suggested precautions were exercised in its use in field operations, no deleterious effects occurred to crops or operators during the 1947 season. Other notations were given by the Conference regarding parathion: that it will be available in 1948 as a 15 percent wettable powder; for control of orchard mites, ¼ pound of 15 percent wettable powder per 100 gallons of water has given "excellent results;" that in order to avoid residue problems, fruit should not be sprayed within 30 days before harvest; that applications of parathion by dust machines, fog machines, speed sprayers, airplanes and similar equipment is not recommended because of potential health hazards and reduced effectiveness in control.

Last year's comments on DDT were repeated, with the additional notation covering the use of dinitro compounds in combination with DDT. These have given satisfactory control of some species of mites, the report states. Organic phosphate sprays have controlled the active stages of mites, and in some areas sulfur sprays have given satisfactory control of these insects.

Suggestions for dormant sprays were also similar to last year's, with the addition of information concerning control of mites. In this regard, it was suggested that whether oil emulsion or lime sulfur should be used as a dormant application depends on the mites, insects, or fungus diseases to be controlled. In limiting the damage from certain mites, insects or plant diseases, dormant oils should be alternated with lime sulfur where advisable in order to hold in check the increase of those mites, insects or diseases that may develop from the annual use of either spray alone, the report says.

Further information on summer sprays included the addition of "Zerlate" in spray schedules for control of peach diseases, in addition to last year's mention of "Fermate."

Information on summer DDT spray schedules states that when DDT residue exceeds 10 ppm at har-

* Complete report appeared in March, 1947 issue of AGRICULTURAL CHEMICALS.

PYROPHYLLITE

Ideal As A

DILUENT

AND

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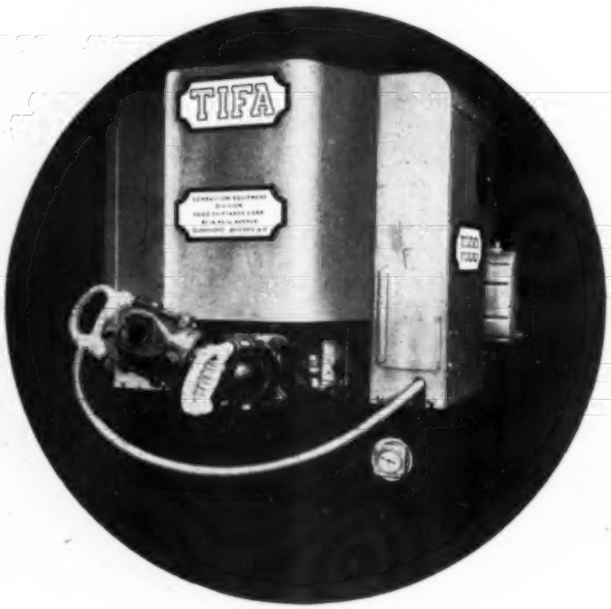

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vest time, present washing practices are ineffective.

The Western Cooperative Spray Conference based its suggestions on data accumulated from twenty years of experimental work.

•

Armour Display Booth

Armour and Company, Chicago announces that the above display booth will be used at a number of scientific and technical exhibits planned for the near future. Plans are now under way to present a number of new biochemical and chemical products to members of the Federated Biological Societies at their first commercial exhibit at Atlantic City, March 15 to 19, incl.

•

February Meetings Held

Meetings in various parts of the country were scheduled for February at dates too late for full reports to be given in this issue of *Agricultural Chemicals*. Such meetings included the Cotton States Branch of the A.A.E.E., Atlanta, February 4, 5 and 6; Western Weed Control Conference, Sacramento, California, Feb. 1, 2, 3 and 4; Joint meeting of the Potomac and Southern Division, A.P.S., February 12, 13 and 14, Beltsville, Md.; and Midwestern Chapter of the National Shade Tree Conference, Chicago, February 19 and 20. Arrangements have been made to publish reports of these meetings in our next issue.

•

Centennial Is Observed

In observance of its 100th anniversary, the American Pomological Society was scheduled to hold a three day meeting at Hotel Jefferson, St. Louis, Mo., February 17, 18 and 19. The Illinois and Missouri horticultural societies were hosts to the Pomological group. Speakers listed on the program included Dr. R. M. Bullock, Dept. of Horticulture, Washington Agricultural Experiment Station, Wenatchee, Washington; Richard P. White, Executive Sect'y, American Ass'n. of Nurserymen, Washington, D. C.; Dr. M. J. Dorsey, Dept. of Horticulture, Univ. of Illinois; Dr. George M. Darrow, U.S.D.A., Beltsville, Md.; E. F. Palmer, Director, Vineland Experiment Station, Ontario, Canada; and Clarence W. Kitchen, Executive Secretary, United Fresh Fruit and Vegetable Ass'n.

•

To New St. Regis Post

Arch Carswell has been appointed by St. Regis Paper Company, New York, to become general sales manager of the firm's Multiwall Bag Division. Mr. Carswell joined the company in 1928, and assumed his new duties on January 12, this year.

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His headquarters will be in New York. Mr. Carswell, formerly manager of the Pacific Coast Division, is succeeded in this position by H. W. Sloan, former assistant manager of the Pacific Coast Division.

ARCH CARSWELL

•

Lynch Joins Velsicol

DAVID W. LYNCH

David W. Lynch has joined the Velsicol Corp., Chicago, as sales manager of the insecticide department. Mr. Lynch became associated with Velsicol on February 1 after fourteen years with John Powell & Co., New York, representing the sales department of the latter firm in the Midwest and Southwest with headquarters in Chicago. He has been active in the affairs of the NAIDM and the NPCA and is well known in the insecticide circles.

•

Nebraska Weed Meeting

The second annual state weed conference, chemical and equipment show was held at the Nebraska state fair grounds, Lincoln, January 8 and 9. The meeting, of educational nature, was planned to bring out the latest information on 2,4-D and its correct application. Weed specialists from various sections of the state presented data accumulated during the past year, and special stress was placed on crop injuries caused by excessive dosages of the herbicide. Varieties of a given crop differ in degree of tolerance to 2,4-D they reported.

These differences are great enough to demand special care in treating weeds in various areas where the crop is planted. Results thus far have indicated that definite promise of a more efficient spraying operation is in the offing, and that use of the required amount of 2,4-D acid in volumes as low as 5 gallons per acre showed promise.

Seed cleaning and treating demonstrations were made at the meeting to illustrate the value of this type of operation in removing many

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weed seeds, cracked and chipped grain, and introducing a chemical dust to control seed borne diseases. Such treatments increase the total crop yield by reducing weed competition and making the plant more resistant to certain plant diseases.

The Nebraska weed program is based on district organization. There are 86 weed districts in the state, with 413 weed district supervisors and 17 district managers as well as a large number of equipment operators, comprising an area of about 32 million acres. A "War on Weeds" campaign has been initiated to further the interest in weed control activities in Nebraska. Its purpose is largely educational.

WEED CONFERENCE

(*Continued from Page 57*)

hand hoeing of widely spaced transplanted crops by the use of contact herbicides. 2,4-D and methyl ester of naphthalene acetic acid were not satisfactory for this purpose.

A paper prepared by A. M. S. Pridham, B. B. Stangler and P. B. Kaufman all of Cornell University, reported the response of woody ornamentals to 2,4-D. They found that injury to these ornamentals from 2,4-D can be minimized or eliminated by spraying during the dormant period. Weed control in lawn, golf course, park and highway areas during winter is a real possibility. The treatment of soil to eliminate fleshy rooted perennial weeds is a possibility among woody plants. The amount of 2,4-D necessary to accomplish these objectives appears to be 5 to 10 pounds per acre. Perennials cannot be weeded safely with 2,4-D as a herbicide.

Other topics on the advance program included studies of crab grass control in turf, pre-emergence weed control in corn, the herbicidal properties of certain pure hydrocarbons, and the control of weeds in salt marshes.

Officers of the Northeastern Weed Control Conference are G. H. Ahlgren, Rutgers University, New Brunswick, N. J., chairman; B. H. Grigsby, Michigan State College, E. Lansing, vice-chairman; and R. D. Sweet, Cornell, secretary-treasurer. The program committee was headed by Benjamin Wolf, Seabrook Farms, and C. S. Harris, Shell Oil Co., N. Y.

CATTLE PEST CONTROL

(*Continued from Page 31*)

had developed sores on the teats and at the sides of the udders at the hair whorl showed a marked improvement in their condition and, in many instances, a complete healing of these lesions due to absence of flies. Animals which did not have lesions at the beginning of the series of applications did not develop them. Animals in both herds came into the fall period without welts and sores on their necks and around the bases of their tails, and other portions of the body which can be reached by neither tail nor tongue.

No studies were attempted which would determine body weight

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changes since it has already been established that fly-free animals gain weight.

Summary

FIELD investigations carried out on several dairy farms in northwestern New Jersey during the 1947 season, indicated good control of blood-sucking flies through the use of an insecticide concentrate containing 10% technical piperonyl butoxide, 1% pyrethrins, and 89% solvents and emulsifiers, with 9 parts water. Five days' control followed the first application, and 7 days' control followed subsequent applications. The effectiveness of the control was arbitrarily considered to be terminated when 6 to 10 flies of all species present were counted on any one animal.

An estimated 3 minute per cow, should be allowed which includes time for preparing and agitating the spray. The best actual spraying time for a dairy cow was 1 minute 30 seconds. Applications of sprays were made in conjunction with usual daily operations so that there was no disruption of normal routine.

Beef cattle, Aberdeen Angus breeding stock, were confined in a chute. The fly control period was 7 days with the first application.

No pathological conditions of any type could be found following continued applications week after week. When animals were given weekly applications, welts and sores resulting from fly bites disappeared and healed, and no new ones appeared. No fluctuations in milk production could be noted.

The immediate reaction on the part of the treated cattle was the absence of restlessness. The nervousness, more pronounced among heifers and beef cattle than matrons during the first application, disappeared with subsequent sprayings.

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ANHYDROUS AMMONIA

(*Continued from Page 27*)

Table 2

Test Number	Source of Nitrogen and Depth of Application: Anhydrous Ammonia 5 inches	Ammonium Nitrate Surface
	Increase in yield lbs. seed cotton per acre	
1	193	175
2	305[1](242[2])	180[1](92[2])
3	258	104
4	98	48
5	305	159
6	105	125
7	207	225
8	263	215
Average	217	154

1. Based on one picking and boll counts.
2. One picking.

Table 3

Test Number	Source of Nitrogen: Anhydrous Ammonia	Ammonium Nitrate
	Increase in yield bu. oats per acre	
1	30	16
2	32	15
3	30	16
4	29	20
5	19	10
6	25	15
7	12	8
8	15	8
9	14	10
10	4	5
Average	21	12

Table 4

The response of oats to fall and spring applied ammonium nitrate.

Test Number	Time of application of Ammonium Nitrate: Spring	Fall
	Increase in yield bu. of oats per acre	
1	21	16
2	25	15
3	25	16
4	27	20
5	20	10
6	30	15
7	19	8
8	22	8
9	24	10
10	24	5
Average	24	12

the ammonia was applied deep enough for cotton to use it, while the ammonium nitrate in the dry surface soil was less available.

Response of Oats to Anhydrous Ammonia and Ammonium Nitrate

NITROGEN was applied to oats at the rate of 32 pounds per acre from anhydrous ammonia and

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ammonium nitrate. Anhydrous ammonia was superior to ammonium nitrate for fall application to oats planted for grain production, as shown by data reported in table 3.

Even though fall applied anhydrous ammonia was much superior to fall applied ammonium nitrate it should be pointed out that spring applied ammonium nitrate was much superior to fall applied ammonium nitrate, as shown by data in table 4. Ammonium nitrate applied in the fall was not a satisfactory source of nitrogen for the production of grain by oats on any soil, while anhydrous ammonia applied in the fall was a good source of nitrogen on many soils.

Fall applied ammonia was a good source of nitrogen on strongly acid soils where the rate of nitrification was slow:

No. of Tests	pH of Soils	Rate of Nitrification	Increase in yield—bu. oats per acre Anhydrous Ammonia—Fall	Nitrate—Spring
5	5.1 or lower	Slow	28	24
5	5.5 or higher	Fast	14	24

The fall application of ammonia was made in October. The spring application of ammonia was usually made in February or March. Where the rate of nitrification of ammonia was slow, the soil was able to retain the ammonia until spring; where the rate of nitrification was high, much of the ammonia was apparently converted into the nitrate form which leaches.

On one soil with a pH of 4.95 the following data were obtained:

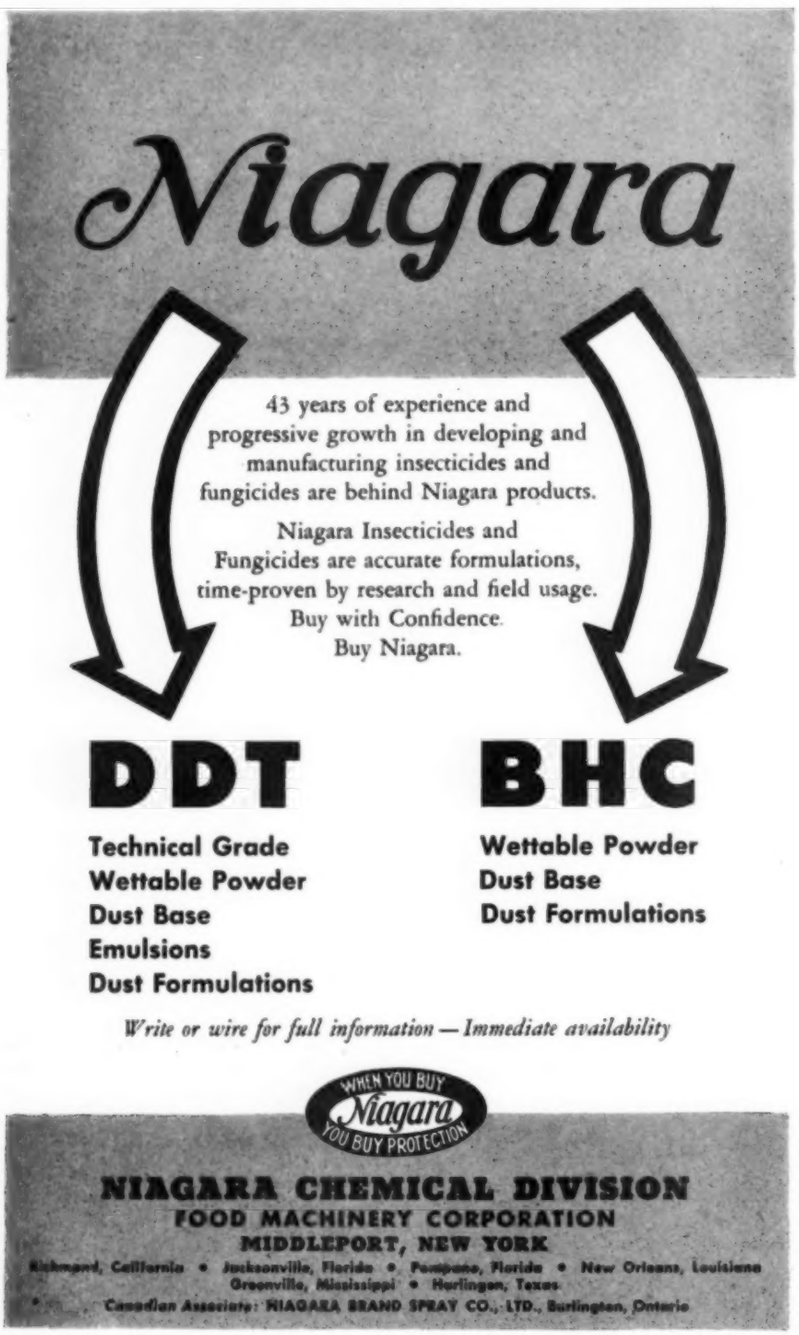
Source of Nitrogen	Time of Application	Increase in yield bu. oats per acre
Anhydrous Ammonia	Oct.	29
Aqua Ammonia	Jan.	30
Ammonium Nitrate	Mar.	27

On this acid soil, October and January were satisfactory dates for applying ammonia. On one soil with a pH of 5.1 these data were obtained:

Source of Nitrogen	Time of Application	Increase in yield bu. oats per acre
Anhydrous Ammonia	Oct.	19
Anhydrous Ammonia	Mar.	10
Ammonium Nitrate	Mar.	20

The acidity of this soil was such that nitrification was slow and fall applied ammonia was equal to spring applied ammonium nitrate. March applied ammonia produced one-half the increase in yield of oats of the spring applied ammonium nitrate or fall applied ammonia.

Young oats apparently use ammonium and nitrate nitrogen equally well. Based upon the above data and observations, fall planted oats do not use nitrogen in the ammonium form in the spring. When ammonia is applied in the spring, it is necessary to apply it early enough for considerable nitrates to be available when early growth starts in the spring, which of course will vary with the reaction of the soil.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On one soil with a pH of 7.8 the following data were obtained with oats:

Source of Nitrogen	Time of Application	Increase in yield bu. oats per acre
Anhydrous Ammonia	Oct.	9
Anhydrous Ammonia	Mar.	25
Ammonium Nitrate	Mar.	24

The ammonia was converted into nitrates rapidly on this soil; October application of ammonia was unsatisfactory, while March application was satisfactory.

Ammonia may be applied and sealed in the soil satisfactorily before planting oats; however, sealing ammonia presents a problem in top dressing oats. More work is needed on this phase of the investigations The application of ammonia as a top dressing for small grains is not recommended as being entirely satisfactory; however, it is anticipated that many farmers will try it out and that they may learn to do it satisfactorily.

In the above tests with oats, nitrogen was applied at the rate of 32 pounds of nitrogen per acre. The ammonium nitrate was applied broadcast. The ammonia was applied in bands of 16 inches apart.

Ammonia was equal to, or slightly superior to, ammonium nitrate for fall and winter forage production in three tests. The ammonia was applied in bands 12 inches apart. Nitrogen was applied at the rates of 32 and 64 pounds per acre on oats planted the last week in September. The oats used most of the nitrogen and produced nearly all of the forage by the first week in December.

Though the evidence is indirect, it appears that ammonia will be superior to ammonium nitrate for the production of both forage and grain where more nitrogen is applied in the fall than is used by early winter. The superiority of ammonia over ammonium nitrate would be due to a better carry-over of unnitrified ammonia.

It has been observed that fall applied nitrogen prevents heaving of oats. The nitrogen increases the root growth sufficiently to prevent the oats from being lifted out of the ground by the ice.

AQUA ammonia and anhydrous ammonia have equal value for crop production. The determining factor in the choice of these two products is one of cost applied to the land. The factors which determine costs are: (1) wholesale price, (2) freight, (3) retailers' margin, (4) storage costs, (5) local transport costs, and (6) cost of application. With a given set of conditions, the approximate cost of each may be calculated. However, the use of both is so new that the storage and distribution pattern has not been established. It is probably entirely safe to say that anhydrous ammonia was cheaper last year than aqua ammonia could have been.

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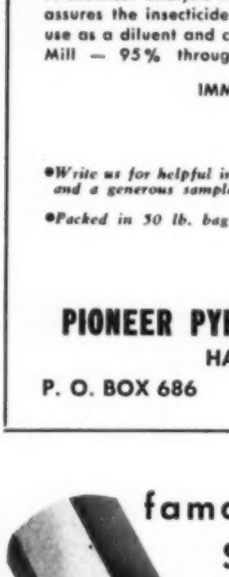

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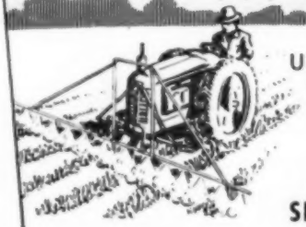

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POWDERED TALC

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Dalton - - Georgia

ing pressure of 200 pounds per square inch and provisions for shading, sprinkling, or insulation should be made for extremely hot weather. Provision is made for the necessary safety features. Horton spheres are probably the cheapest containers for storage of anhydrous ammonia in large quantities. Aqua ammonia tanks should have a working pressure of 10 pounds per square inch.

Anhydrous ammonia is metered by means of a differential pressure regulating valve, or by means of a needle valve and pressure gauge. The pressure gauge setting varies as the tank pressure varies. Tables are provided in the references cited for obtaining the desired rate of nitrogen from anhydrous ammonia with different tank pressures and tractor speeds. In experimental work anhydrous ammonia is metered by means of a rotameter. Aqua ammonia is metered by means of a metering pump which is geared to the tractor.

Both aqua and anhydrous ammonia are applied in the soil by means of a knife-type opener or other suitable device, and covered simultaneously with disc hillers, sweeps, or other plows being used.

Summary and Conclusions

DATA were reported for three years experimental work on the use of anhydrous ammonia for crop production. The equipment used to apply aqua ammonia was mentioned briefly, with reference to the literature cited for details of its construction and use. Information gained from the first year's experience in using it on a farm scale shows that:

1. Anhydrous ammonia is equal to, or superior to, ammonium nitrate for row crop production.
2. Deep application of nitrogen used for side dressing on dry years is essential.
3. Anhydrous ammonia is a satisfactory source of nitrogen for oats; however there are problems in using it for top dressing.
4. The choice between anhydrous and aqua ammonia depends upon total cost applied to the land.
5. Satisfactory equipment has been developed for applying both aqua and anhydrous ammonia.
6. About 200,000 acres of row crops have been fertilized with anhydrous ammonia this year, most of which was in Mississippi.
7. Anhydrous ammonia may be applied in combination with other cultural operations.

Literature Cited

1. ANDREWS, W. B. *The Response of Crops and Soils to Fertilizers and Manures.* Published by the author.
2. ANDREWS, W. B., EDWARDS F. E., AND HAMONS, J. G. *Ammonia As a Source of Nitrogen.* Mississippi Agricutural Experiment Station Bulletin, May 1947.

CALIF. ENTOMOLOGY

(*From Page* 41)

per 8-inch terminal, both compared with the untreated check plot which

CHIPMAN
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FUNGICIDES
WEED KILLERS

Arsenical Insecticides
HI-TEST LEAD ARSENATE
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Fungicides
COPPER HYDRO • COPPER HYDRO BORDO • COPPER HYDRO DUSTS
DRY LIME SULFUR • WETTABLE SULFUR • DUSTING SULFURS

Weed Killers
2,4-D SPRAY POWDER • 2,4-D AMINE (Liquid) • 2,4-D ESTER (Liquid)
2,4-D DUSTS • ATLACIDE (Chlorate) • ATLACIDE WITH 2,4-D
CHLORAX • SODIUM CHLORATE • ATLAS "A" (Arsenical)

Hormone Products
FRUIT SET SPRAY POWDER • FRUIT SET DUST • STOP SPROUT

Write for Literature

CHIPMAN CHEMICAL COMPANY, INC.
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Manufacturers of Insecticides and Weed Killers for Over 25 Years

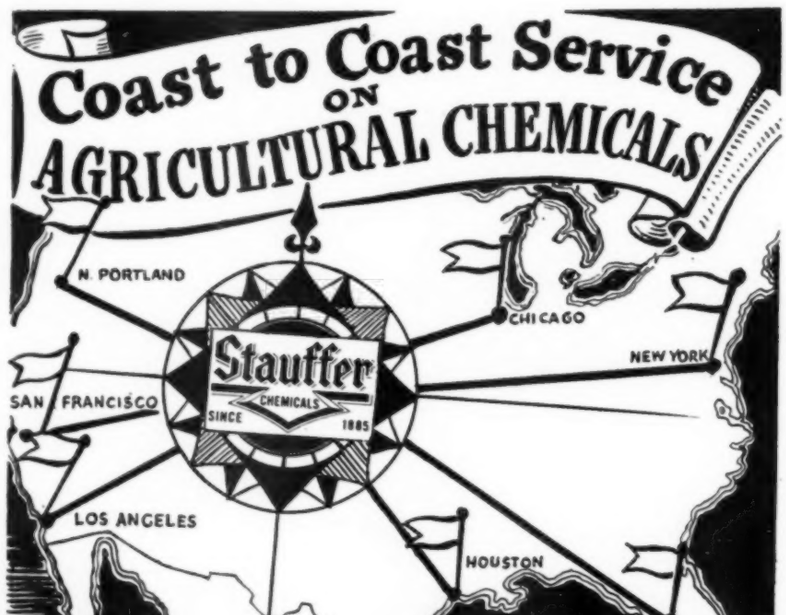
showed 7.8 live scale per 8-inch terminal.

L. R. Jeppson, Univ. of Calif. Citrus Exp. Sta., Riverside, spoke on field studies of mites on citrus. HETP and TEPP are toxic to all stages of citrus red mite except the eggs. Residual action of these materials is too short for them to offer promise for practical control of this mite on citrus. Parathion is toxic to all four mites that are important on citrus, namely, citrus red mite, six spotted mite, citrus bud mite and the citrus rust mite. Typical results are (A) "Thiophos 3422" applied as sprays and dusts is very effective in killing young or adult *citrus red mite* but did not kill eggs at dosage used and residue was not effective long enough to give control with one treatment; (B) "Thiophos 3422" wettable (parathion 25%) applied at dosage of 2 lbs. per 100 gals. water or 1% parathion dust gave effective control of *six-spotted mites* in preliminary tests; (C) "Thiophos 3422" wettable (parathion 25%) applied at 4 lbs. per 100 gals. water offers promising results in control of *citrus bud mite*, whereas lower dosages do not appear promising; (D) "Thiophos 3422" wettable (parathion 25%) applied at 1½ lbs. per 100 gals. water and 2% parathion dust both offer promise in control of *citrus rust mite*.

G. E. Carman and J. C. Ortega, Univ. of Calif. Citrus Exp. Sta., Riverside, discussed citrus aphids. HETP and TEPP applied as full coverage sprays and also as atomized sprays with spray-dusters were effective in citrus aphid control, although a good wetting agent supplement is essential. HETP dusts are not consistently effective regardless of the diluents used. TEPP dusts were effective. Parathion dust mixtures show promise.

Allen B. Lemmon, Calif. State Dept. Agric., Bur. of Chem., Sacramento, spoke on the present registration situation. Economic poisons containing hexaethyl tetraphosphate and tetraethyl pyrophosphate have been accepted for registration as economic poisons in California. The labels carry necessary warnings. There has been some confusion with regard to proper ingredients statement but now there has been a general agreement that the active ingredient in both products will be given in terms of tetraethyl pyrophosphate.

No requests have yet been received for registration of economic poisons containing parathion. The discussion indicates that it has great promise for control of a variety of pests but before registration can be issued for application of the product to edible portions of crops, we need information concerning its chronic effects, possible absorption in produce, and what, if any, spray residue tolerance will be permitted. It appears acceptable for registration with suitable cautions on the label for use against certain pests where it will not be applied to edible portions of food crops.★★



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Industry Patents

The following patents have recently been issued by the U.S. Patent Office on products and devices in the agricultural chemical field. Copies of the patents may be obtained at 25c each by addressing the U.S. Patent Office, Washington 25, D.C.

2,433,106. A,4-DINITROPHENYL AS A FUNGICIDE. Patent issued December 23, 1947, to Albert L. Flenner and Russell A. Kaberg, Wilmington, Del., assignors to E. I. duPont de Nemours & Co., Inc., Wilmington. A fungicidal composition comprising a mineral oil solution of 2,4-dinitrophenyl thiocyanate containing a minor amount of an aromatic hydrocarbon solvent, said 2,4-dinitrophenyl thiocyanate being present in said solution in excess of its normal solubility in said mineral oil and said aromatic hydrocarbon solvent stabilizing said solution to prevent separation of 2,4-dinitrophenyl thiocyanate.

2,433,178. SEED CLEANER. Patent issued Dec. 23 to Arthur J. V. Ware, Memphis, Tenn. A seed cleaner, including a vertically disposed outer casing of circular cross section, an abrasive lining as of wire mesh removably disposed in said casing, a centrally apertured head secured to the upper end of said casing, and inner casing concentric with said outer casing integrally secured to said head around said aperture and depending therefrom, a spiral flight integrally secured around the outside of said inner casing, substantially throughout the length of said casing, said flight radially being of width to closely but removably lie along the abrasive lining of said outer casing and cooperate with said casing to establish a spiral passageway, and an exhaust pipe leading from the central aperture of said head, said upper head being detachably secured to said outer casing to permit removal of said inner casing for renewal of said abrasive lining.

2,433,463. SPRAY GUN AND METHOD OF SPRAYING. Patent issued Dec. 30, to Arthur J. Lampe, Chicago, assignor to Sprayo-Flake Co., Chicago. In the art of spraying a divided material and an adhesive, whereby the material is rendered adherent for application to selected surfaces, the improvement comprising simultaneously projecting a spray of said material and a plurality of cone-like sprays of said adhesive, said adhesive sprays being differently pitched relative to the chosen path of different points.

2,433,491. INSECTICIDAL COMPOSITION OF PYRETHRUM AND A METHYLENE DIOXYPHENYL SYNERGIST. Patent issued December 30, to Martin E. Synerholm, Hastings on Hudson, N. Y., assignor to Boyce-Thompson Institute for Plant Research, Yonkers, N.Y. An insecticidal composition comprising pyrethrum and a compound of the group consisting of alpha-phenylbeta—(3-4 methylenedioxyphenyl) acrylonitrile, alpha-phenylbeta — (3-4 methylenedioxphenyl) acrylonitrile, alpha-phenylbeta — (3,4-methylenedioxyphenyl) N-cyclohexylacryimide, and alpha-cyanobeta — (3,4-methylenedioxyphenyl) N-cyclohexylacrylamide.

2,433,525. BISDIBUTYLAMINOALKANES AS INSECTICIDES Patent issued December 30, 1947, to Glen H. Morey, Terre Haute, Ind., assignor to Commercial Solvents Corp., Terre Haute, Ind. An insecticidal composition comprising a bisdibutylaminoalkane in which the alkylene groups, both ends of which are singly bonded to a separate nitrogen atom, contain from three to four carbon atoms, and a carrier therefor.

2,433,742. HALOGEN SUBSTITUTED ACRYLONITRILES AS INSECTICIDES. Patent issued December 30, 1947, to Harold S. Davis, Greenwich, Conn., assignor to American Cyanamid Co., New York. A method of combatting insects which includes exposing them to a toxic quantity of a halogen substituted acrylonitrile.

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This amazing new basic insecticide material is a revolutionary improvement on standard HETP for control of aphids, spider-mites and other insects.
Eston TETRON has approximately twice the strength of standard HETP and the price per unit of active ingredient has been drastically reduced.
AVAILABLE IN 3 FORMS:
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A straight chemical containing 100% active ingredient.
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50% active ingredient plus 50% solvent and emulsifier.
TETRON 25
25% active ingredient plus 75% solvent and emulsifier.
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2,433,204. PREVENTION OF DETERIORATION OF GRAIN. Patent issued January 6, 1948, to Charles G. P. Feachem, Northwich, Eng., assignor to Imperial Chemical Industries, Ltd. The process for combatting insects in grain and pulses which comprises incorporating therein 0.05—0.5% by weight of *v*-alumina prepared by precipitating aluminum hydroxide from an alkaline solution of sodium aluminate, washing, drying, and activating the precipitated hydroxide by heating it for 2-24 hours at 250°-500° C., and pulverizing it to an average particle size substantially below 10 microns.

Trade Mark Applications

POTA-TOX, in capital letters, with extended cross-bars on letters "T," for insecticidal composition consisting essentially of tricalcium arsenate and basic copper sulfates and basic copper chlorides for use as a spray or dust on plant having hardy foliage, such as potatoes. Filed July 19, 1944, by Niagara Sprayer & Chemical Co., Middleport, N. Y. Claims use since June 7, 1945.

GAMMACIDE, in sans serif capital letters, for parasiticides—namely, insecticides and fungicides. Filed Feb. 26, 1947, by California Spray-Chemical Corp., Richmond, Calif. Claims use since Sept. 4, 1945.

PARCLAY, in capital letters, for clay carrier or diluent for insecticides and fungicides. Filed May 16, 1947, by R. T. Vanderbilt Co., Inc., New York. Claims use since Feb. 7, 1947.

KOP-O-RITE, in hand-drawn capital letters, with stem of letters "K" and "R" extending under the other letters, for insecticides. Filed June 19, 1947, by Andrew Wilson, Inc., Springfield, N. J. Claims use since January, 1947.

SELECT-O-WEED, in hand-lettered capitals drawn in a semicircle.. For preparation for killing weeds. Filed Jan. 14, 1947, by Andrew Wilson, Inc., Springfield, N. J. Claims use since April 24, 1946.

TAILSPIN, in hand-drawn capital letters, for insecticides. Filed March 24, 1947, by The Cornelius Company, Minneapolis, Minn. Claims use since January 1, 1947.

ISOTOX, in sans serif capital letters, for insecticides. Filed Apr. 15, 1947, by California Spray-Chemical Corp., Richmond, Calif. Claims use since Sept. 18, 1945.

TRUSDIDT, in Ultra Bodoni capitals, for insecticides. Filed June 30, 1947, by Chemola Mfg. Co., Houston, Tex. Claims use since June 27, 1947.

MR. O's, on an auto-trailer motif, for liquid and dry fertilizers. Filed Aug. 3, 1946, by Anthony Oberholtz, Los Angeles, Calif. Claims use since Feb. 10, 1946.

BUG-FIX, in tall gothic capitals and lower case letters, for insecticide preparations. Filed Aug. 27, 1946, by Frank A. Hart, New York. Claims use since June 1, 1926.

ERUSTO, in hand-drawn letters, with outline, for insecticides. Filed Jan. 10, 1947, by Pennsylvania Salt Mfg. Co., Philadelphia, Pa. Claims use since Aug. 8, 1946.

CONCENTRIC CIRCLE drawn in front of triangle, with letters "I" "A" "A" in the three corners of the triangle, for fertilizers and legume type seed inoculants. Filed Sept. 5, 1946, by Illinois Agricultural Association, Chicago. Claims use since March, 1941.

SPRA-SHIELD, on a shield, for spray for shrubs and trees. Filed Dec. 7, 1946, by Spra-Shield Co., Grand Rapids, Mich. Claims use since Nov. 25, 1946.

GARDEN MAGIC, in Cooper caps and lower case, for soil conditioner—namely, pulverized limestone. Filed May 26, 1947, by J .M. Stevenson, doing business as Kanstone Co., Garnett, Kansas. Claims use since on or about Feb. 10, 1946.

CONTINENTAL, in thin capital letters, for clay carrier or diluent for insecticides and fungicides. Filed May 24, 1947, by R. T. Vanderbilt Co., Inc., New York. Claims use since Mar. 25, 1947.

GENUINE PERUVIAN GUANO, on square background, with bird motif, for fertilizer. Filed Mar. 26, 1947, by Naco Fertilizer Co., New York. Claims use since Oct. 1, 1923.

Classified Advertising

Rates for classified advertisements are ten cents per word, $2.00 minimum, except those of individuals seeking employment, where the rate is five cents per word, $1.00 minimum. Address all replies to Classified Advertisements with Box Number, care of AGRICULTURAL CHEMICALS, 254 W. 31st St., New York 1. Closing date: 1st of month.

Positions Open

Wanted— Experienced salesman in midwest, also one on west coast, to represent basic producer of insecticide raw materials and agricultural chemicals. Send full details to box No. 226, care of Agricultural Chemicals.

Technical Sales: Wanted young man with chemistry education and some experience in selling agricultural and/or industrial chemicals. For the right man who is imaginative and who will work conscientiously, we have an interesting position in technical sales development. We are a young and growing manufacturer of fungicides for industry and agriculture and are located in New York City. Address Box 218 care of Agricultural Chemicals.

Entomologist: Young man wanted who is experienced or qualified in the manufacture and sale of insecticides for the Southeast. Give full details, experience to Box 219 care of Agricultural Chemicals.

Field Entomologist: A well-established and nationally known manufacturer of agricultural chemicals requires the services of an entomologist for field work in the Pacific Northwest with headquarters in Washington or Oregon. The duties of the post include the running, observing, checking and reporting of field tests (throughout the territory assigned) with products developed in our research program, and consultation with the trade and state and Government stations. Materials handled include insecticides, fungicides, herbicides, etc. Please include all pertinent personal and professional information and photograph in your reply. Address Box 220 care of Agricultural Chemicals.

Wanted — Chemical engineer and plant superintendent experienced in manufacturing agricultural insecticide chemical raw materials. Address Box No. 227, care of Agricultural Chemicals.

Positions Wanted

Economic Entomologist: Extensive experience in insecticide experimentation, development and sales. Desires position. Address Box 221 care of Agricultural Chemicals.

ALVIN J. COX, Ph.D.
Chemical Engineer and Chemist
(Formerly Director of Science, Government of the Philippine Islands; Retired Chief, Bureau of Chemistry, State of California, Department of Agriculture.)
ADVISOR ON AGRICULTURAL CHEMICAL PROBLEMS AND INVESTIGATIONS
Consultant in reference to spray injury and damage, claims, including imports of fruits and nuts, formulas, labeling, advertising and compliance with law.
1118 Emerson Street
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Laboratory Technician in entomology available February 1. Masters degree, 2 years insectary experience, commercial and university, familiar with rearing technique and toxicology. Address Box 222 care of Agricultural Chemicals.

Miscellaneous

Exporter specializing in the agricultural field is interested in representing manufacturers of insecticides, fertilizers, etc. Address Box 223 care of Agricultural Chemicals.

Plant Physiologist or Pathologist: A major producer of agricultural chemicals in the Middle Atlantic area requires the services of a plant pathologist or plant physiologist with experience in the field of fungicides to conduct laboratory and field evaluation tests of new chemicals as fungicides and herbicides. Permanent position in a well-organized and growing department. In replying, please submit all pertinent professional and personal information. Address reply to: Pennsylvania Salt Manufacturing Company, Director, Whitemarsh Research Laboratories, Box 4388, Chestnut Hill P.O., Philadelphia 18, Pa.

Insecticide Sales: Unusually fine opportunity for man with experience in selling to the insecticide industry. The person should be preferably a graduate in chemistry or entomology, between 35 and 40, and should know and be known in the insecticide and allied industries. Position, assistant to sales manager of long established manufacturing organization. Address Box 224 care of Agricultural Chemicals.

Entomologist, Ph.D. Experience varied. Presently engaged in agricultural insecticide research. Will consider any phase of entomology with future. Address Box 225 care of Agricultural Chemicals.

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AGRICULTURAL CHEMICALS

254 WEST 31st STREET NEW YORK 1

TALE ENDS

RUSSIAN agricultural officials have recently announced a new "secret" method of accelerating the maturity of cotton, according to reports. This method is described as consisting of the application of a "special substance" which causes the leaves to fall off the plants, and to speed the ripening of bolls. American plant physiologists believe that this process must be a copy or duplication of defoliation methods now in quite common use in the south. (See full report in *Agricultural Chemicals*, November, 1947.)

These methods are not restricted to cotton in the U. S., but have been used on soybeans, tomato plants, potatoes, and storage fruits.

•

In a brief speech of acceptance following the announcement of his election to presidency of the American Association of Economic Entomologists in Chicago in December, S. A. Rohwer said "Entomology and the science of insect control are growing up rapidly and are becoming recognized and appreciated. Our association, its high standards, and the excellent leadership it has had, contributed much to this development. I pledge my best to continue and extend past accomplishments. With the help of all I will aim to assure that our science and profession contribute its full part to the economy, health, and peace of our country and the world."

On few occasions have we heard extemporaneous words carry an idea so well.

•

A 2,000 acre forest fire near Los Angeles, thought to be the work of an arsonist, turned out to be the result of a combination of abnormally dry weather and use of sodium chlorate used along the roads to kill weeds. The material, ordinarily absorbed into the ground in wet weather, this time stayed on the surface and became ignited by a stray spark or by hot sunshine, forest officials believe.

PRINTED BY WATKINS PRINTING CO., BALTIMORE

PEA APHID

(Illinoia pisi)

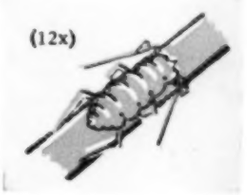
WINGED FEMALE (12x)

BUG OF THE MONTH

THIS is the insect most feared of all by the large growers and canners of peas. Due to its oviviviparous habits, the young are hatched alive, apparently sexually mature and fertile. When unchecked, its increase is phenomenal. Millions of aphids seem to appear in a matter of days and, sucking the sap from stems and leaves, lay waste whole fields.

Infested peas wilt. Bronzy patches appear in the fields. Because of the small size of this pest, it is often overlooked and the damage laid to more conspicuous insects, or to root rot. Yet, even when the insects are not abundant enough to kill the plants or even to cut the yield appreciably, the quality of peas harvested will often be poor.

Methods of control in general practice today are two—dusting with ground cubé root in a suitable dry-powder carrier, and spraying with a water suspension of the same material.



(12x)

For estimating markets, it is safe to figure 4 to 6 lb. of the active insecticide per acre. In actual control work, the recommendations of local extension agents should be followed to the letter.

In any case, the efficacy of your formulations will depend on uniformly high quality root, with known and dependable rotenone content. For this, you can look with confidence to Prentox Cubé Powder. The uniform excellence of this material has made Prentiss the largest handler of rotenone-bearing roots in the United States. The product is completely fiber-free, and the exclusive milling techniques also result in an extremely fine powder—almost micron-sized—resulting in maximum insecticidal action.

Your inquiries are invited. Our specialized knowledge of insecticide materials is at your disposal at all times —for the development of consistently better insecticides.

R. J. PRENTISS & CO., Inc.

110 WILLIAM STREET, NEW YORK 7, N. Y.

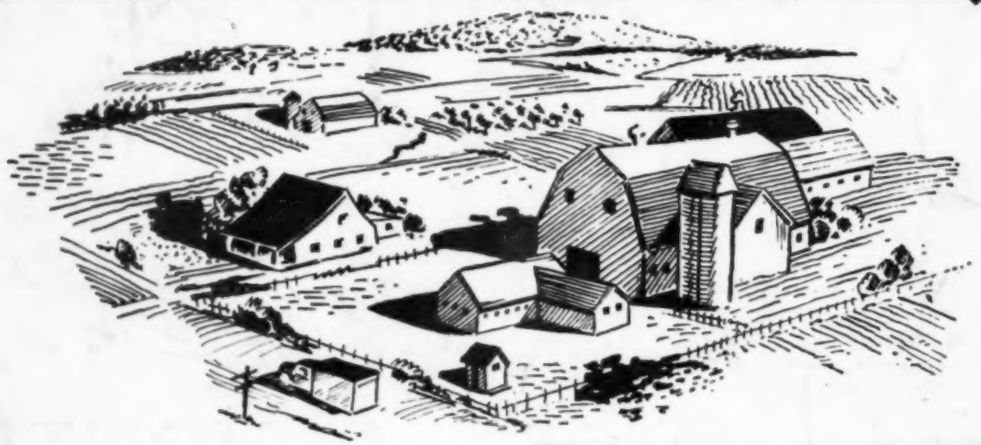
BOX 1407, RICHMOND, CALIF.

9 SO. CLINTON STREET, CHICAGO 6, ILL.

PRENTOX PEST-TESTED INSECTICIDE CONCENTRATES SOLD TO INSECTICIDE MANUFACTURERS ONLY

TOXAPHENE

(HERCULES CHLORINATED CAMPHENE)



Large-scale field tests on thousands of acres of farm land throughout the United States give overwhelming proof that Toxaphene* (Hercules chlorinated camphene) provides effective, low-cost control over many insects that plague the farmer.

During 1947, state entomologists, experiment stations, and other agricultural authorities used over 2,000,000 lbs. of 20% Toxaphene dust to test its effectiveness against cotton insects and other pests.

For 1948, chlorinated camphene dusts are recommended for the control of all important harmful cotton insects. Specific recommendations on the use of chlorinated camphene can be obtained from individual state authorities. For further technical information on this promising new toxicant, write us.

Hercules does not make finished dusts but supplies technical grade chlorinated camphene. Get in touch with your agricultural insecticide manufacturer or supplier for information on dust concentrates or finished dusts containing chlorinated camphene.

CONTROLS

BOLL WEEVIL

BOLLWORM

SOUTHERN GREEN STINK BUG

GRASSHOPPER

COTTON LEAFWORM

COTTON APHID

RAPID PLANT BUG

TARNISHED PLANT BUG

COTTON FLEAHOPPER

MORMON CRICKETS

THRIPS

MANY OTHER AGRICULTURAL INSECT PESTS

* TRADE-MARK OF HERCULES POWDER CO.

HERCULES POWDER COMPANY

INCORPORATED

970 MARKET ST., WILMINGTON 99, DELAWARE